Merits

S1/S3 series
Rhino Service Manual

Nov.9.2006 V1

S1/S3 series-Rhino Service manual

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Introduction

The purpose of this manual is to provide dealers and/or distributors with the product information and instructions that are required for servicing the S1/S3 series electrical scooter.

1 Service Guide

- Batteries
- Motors, Brush and brake
- Tiller instrument
- Electrical illustrated parts breakdown
- Troubleshooting
- Dynamic Rhino controller
- Charger
- Scooter diagnostic flow chart

WARNING

Before performing any maintenance or service, turn the power off. NEVER allow tools and/or battery cable(s) to contact BOTH the battery terminal(s) or the post(s) at the same time. An electrical short may occur resulting in serious personal injury and/or damage. It is strongly recommended that battery installation and/or replacement should be done only by a qualified technician.

2 Batteries

- **Battery type: Lead-acid *2 pieces**

2.1 When to replace the batteries

The batteries may have to be replaced should one of the following conditions occurs:

- **The scooter's driving distance decreases significantly.**
- **Incomplete charge.**
- **The Charging cycle becomes significantly longer or shorter than before.**

2.2 To Remove the Batteries

1. Remove the seat and shroud and unplug rear lights connector.

2. Disconnect the wiring harness from the batteries by removing the screws.
3. Remove the batteries from the scooter base.

2.3 To install the Batteries

1. Install two new batteries into the power chair base.
2. Connect the wiring harness to the batteries. Refer to“Electrical illustrated parts breakdown” diagram.
3. Confirm the battery supply voltage. (the battery voltage to the controller should be at least 25VDC)
4. Plug rear lights connector and cover the shroud and install the seat.

2.4 Checking Battery Charge:

1. Connect the voltmeter negative probe to controller power-.
2. Connect the voltmeter positive probe to controller power+.
3. The voltmeter should measure 23-27 volts (i.e. Battery Voltage).
4. If the voltage is negative, check for correct battery wiring polarity. Ensure that batteries are connected correctly.
5. If the voltage reading is zero, check for wiring open circuits or battery wiring polarity.
6. Charge the batteries completely before driving.

3 Motor, brush and parking Brake

3.1 Motor:

The 24V motors are specifically designed for use on electrical scooter. The motors incorporate a metal-cased parking brake. The parking brake assembly and brushes are protected by a metal cover. The motor frame is integral with the cast aluminum gearbox housing that forms a strong and compact unit. An easy-to-operate brake lever engages/releases the magnetic brake for manual pushing of the scooter.

Connections and Wiring

1. Each motor has four wires of two different sizes that require connection. Note that the red and blue(or black) wire connections will affect the motor orientation.
2. Upon completing all wirings the loom must be fastened to the frame to minimize strain on the connections.

3. Lift the wheels before making the battery connection and check if the drive system functions correctly.
4. Ensure that the scooter's power system is equipped with a circuit breaker or fuses.

Testing

Check the motors and control system when the installation is completed. Note the following points:
The circuit breaker or fuses must be included in the power circuitry.

- **Lift the wheels off the ground;**
- **Do not arc cables to check for power.**
- **Use a multimeter to check the voltage.**

Operation of Brake lever

When it is desired to manually push the scooter, the brake lever is easily released. Simply push/pull the lever on the magnetic brake. Labels are available for indicating the status of the brake lever.

Maintenance and Servicing

The motor is a low-maintenance-required motor and except for periodic checkup, requires no further maintenance under normal conditions. The batteries should be disconnected during any maintenance procedure and in fact their complete removal from the scooter may help access.

- **Check system regularly.**
- **Check for loose, damaged or corroded connectors and terminals.**
- **Replace damaged cabling.**
- **Check motor mountings for tightness.**
- **Clean motor and control system components with a damp cloth.**
- **The cover may be removed to check the brush length.**
- **Check for oil or grease leaks around the seals, output shaft, and brake lever.**
- **Check motor for increased backlash or play, excessive noise or other indications of the gear wear-out.**

Warning:

Do not use the motor if there is any indication of damage or if abnormities such as: damage to the case, grease leakage, abnormal response as well as excessive backlash or play, noise, heat, smoke and/or arcing are present.
Ensure that the motor is securely fastened to the transaxle and the wheel securely fastened to the transaxle.

3.2 Motor Brushes

Each motor contains two or four carbon brushes which may require replacement after operating the scooter a long period of time. Brush replacement is a simple operation:

- **Disconnect the motor.**
- **Remove the end cover to allow access.**
- **Remove the brush.**
- **Check the commutator for excessive wear or unusual burns or erosion marks.**
- **Reverse the above processes to install the new brush, ensuring that the brush is still able to slide in the brush guide.**
- **Ensure the springs seat properly on the brush and the brush wire is placed properly.**

Note:

Ensure correct insulation between motor case and motor wires (refer ISO 7176-14).

- **Always replace all the brushes in both motors at the same time.**
- **Run brushes in for several hours in the forward direction. Ensure that the parking brake is released when operating the motor. (This reduces brush bounce which causes arcing and in turn generates RFI and audible noise.)**

3.3 Parking Brake:

Poor parking brake holding ability indicates the need for replacing the parking brake assembly.

- **Disconnect the motor.**
- **Remove the cover to allow access.**
- **Cut/solder the wires of the park**ing **brake. Avoid excess strain**

on the wires.

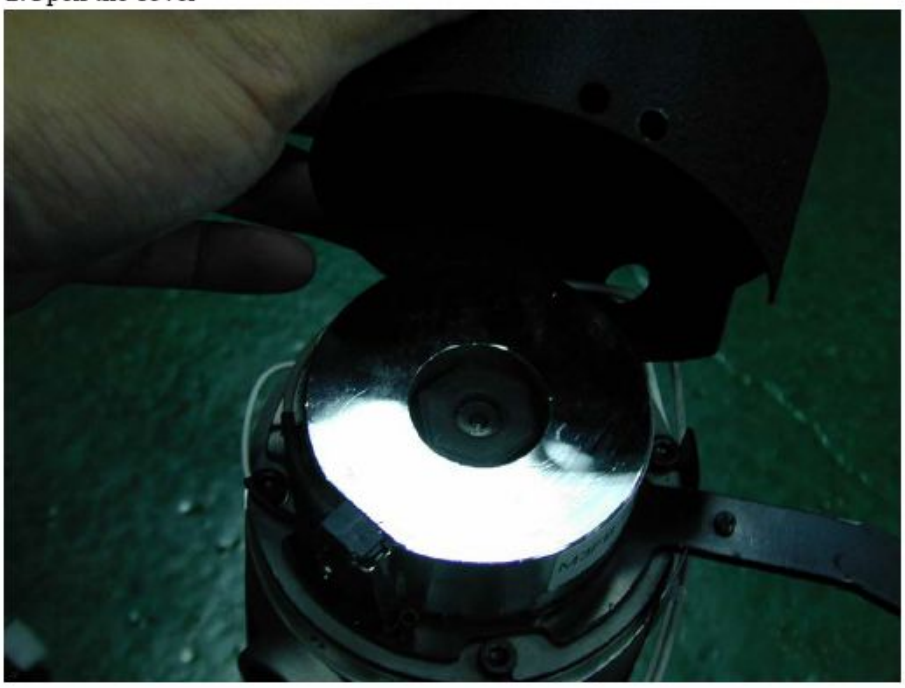
- **Remove the screws that hold the park**ing **brake assembly together.**
- **Reverse the process to install the new park**ing **brake assembly.**
- **Check the armature which must rotate freely with the park**ing **brake disengaged.**

Parking brake replacing procedure:

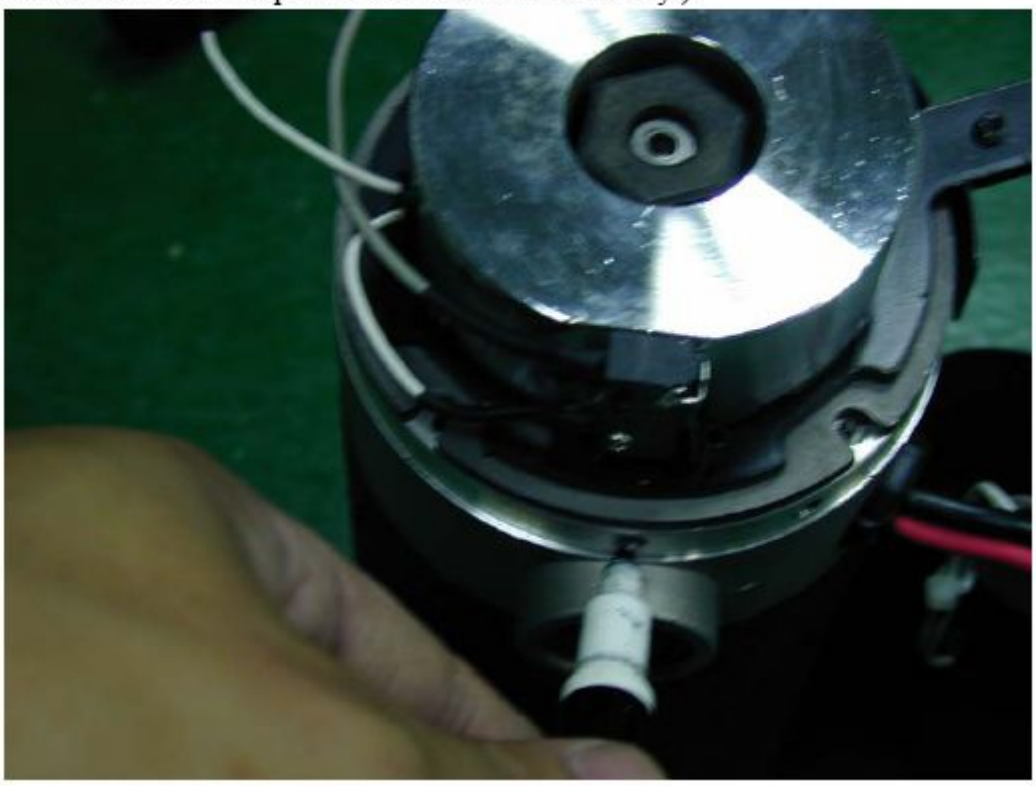
Electromagnetic brake change procedure:

1. Loose the 2 screws out of the cover.(Remember the orientation of the cover in or to place back the cover correctly)

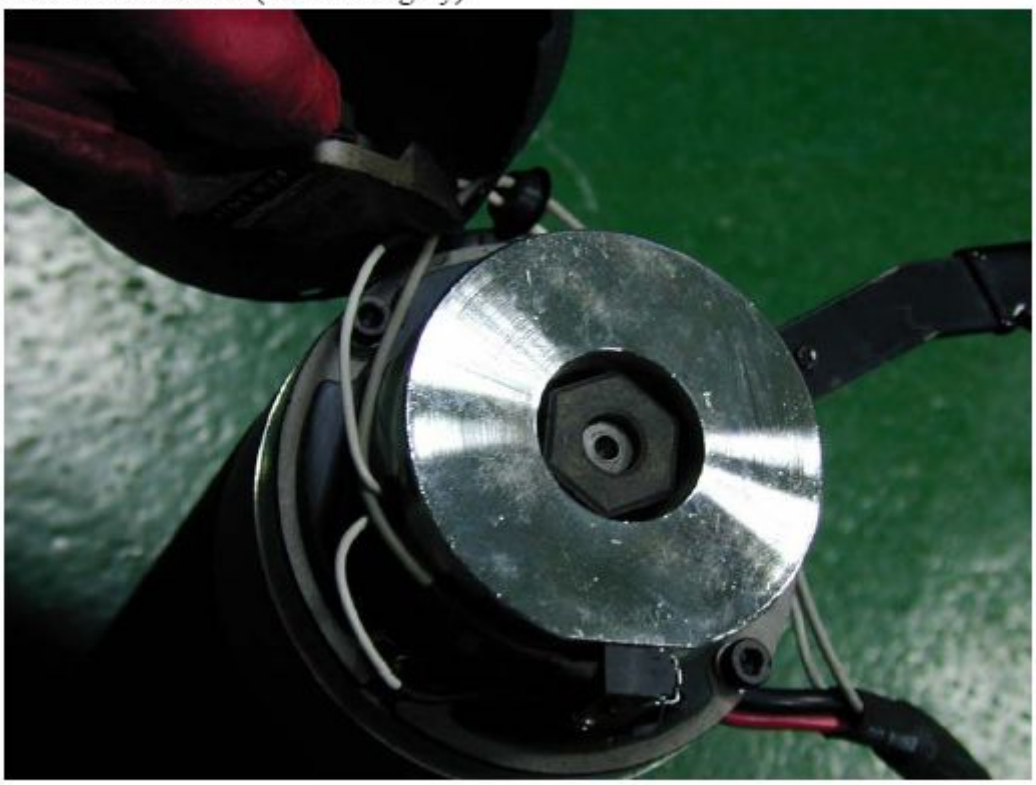
2.Open the cover



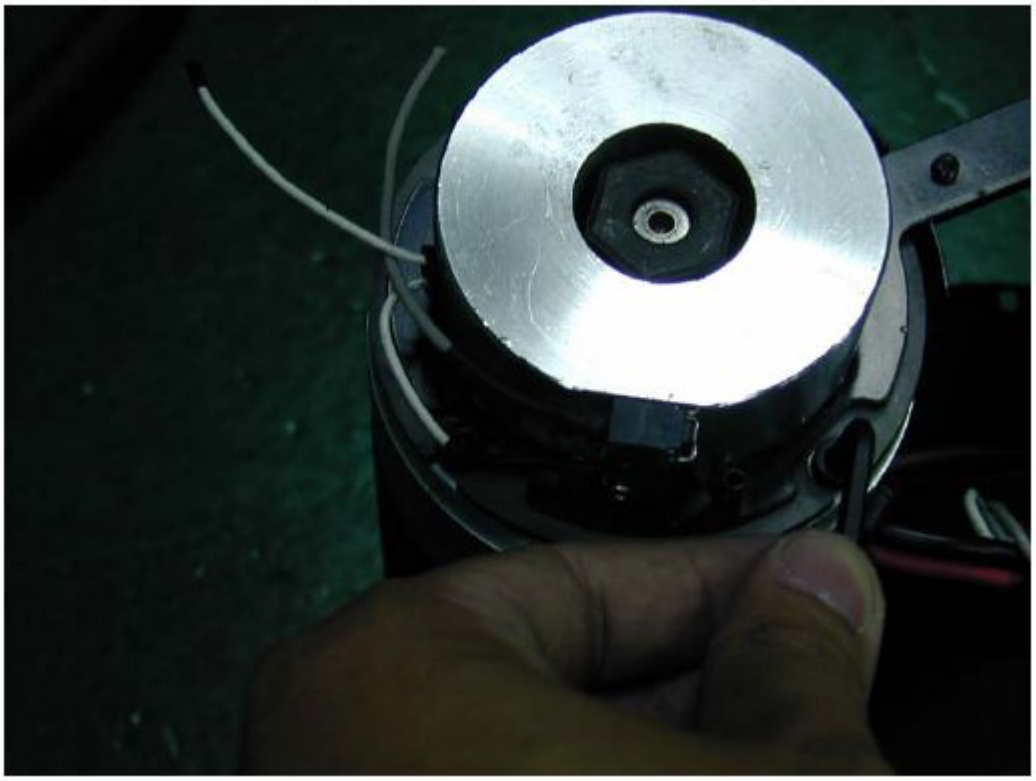
3. Mark the position of the brake related to the motor. (Remember the orientation c
the brake in order to place back new brake correctly)



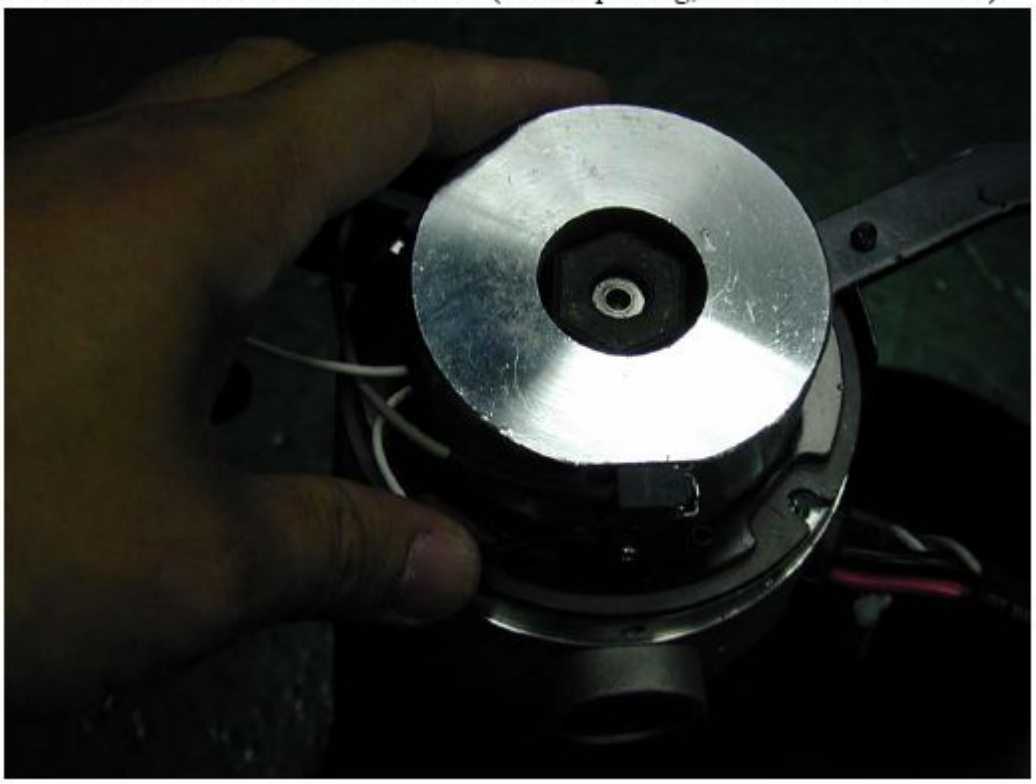
4.Cut off the wires.(white and gray)



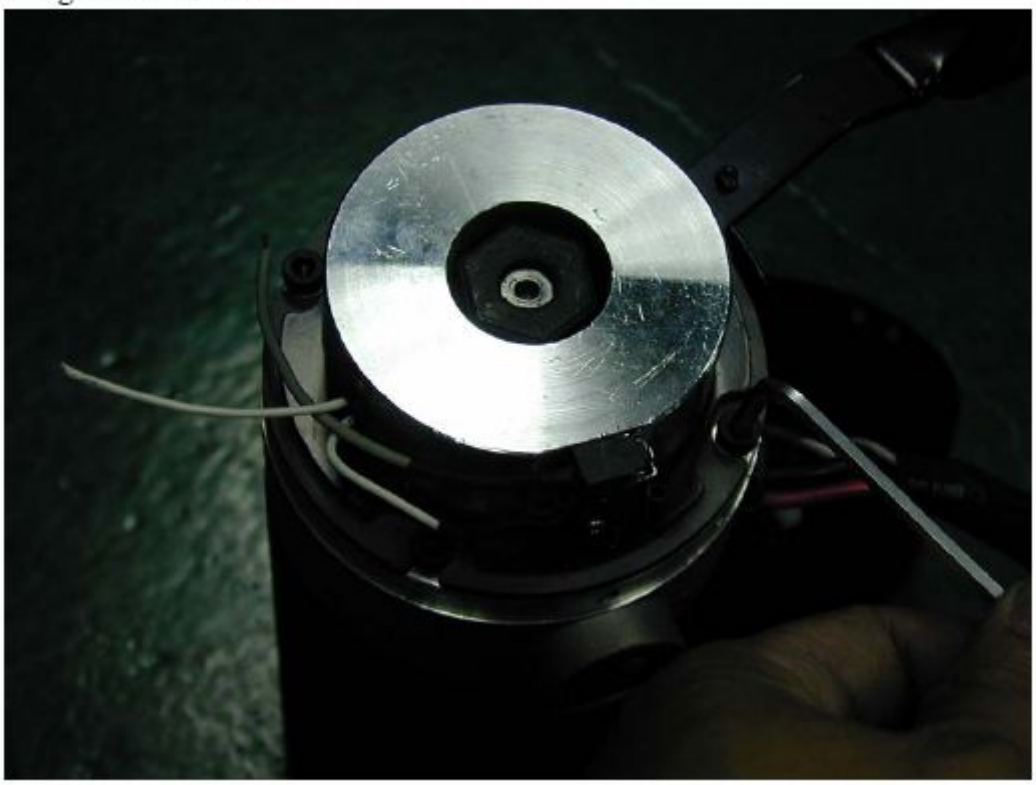
5.Release the clutch and loose the 4 screws out of the brake, then remove the brake



6.Place the new brake onto the motor.(Before placing, release the clutch first)



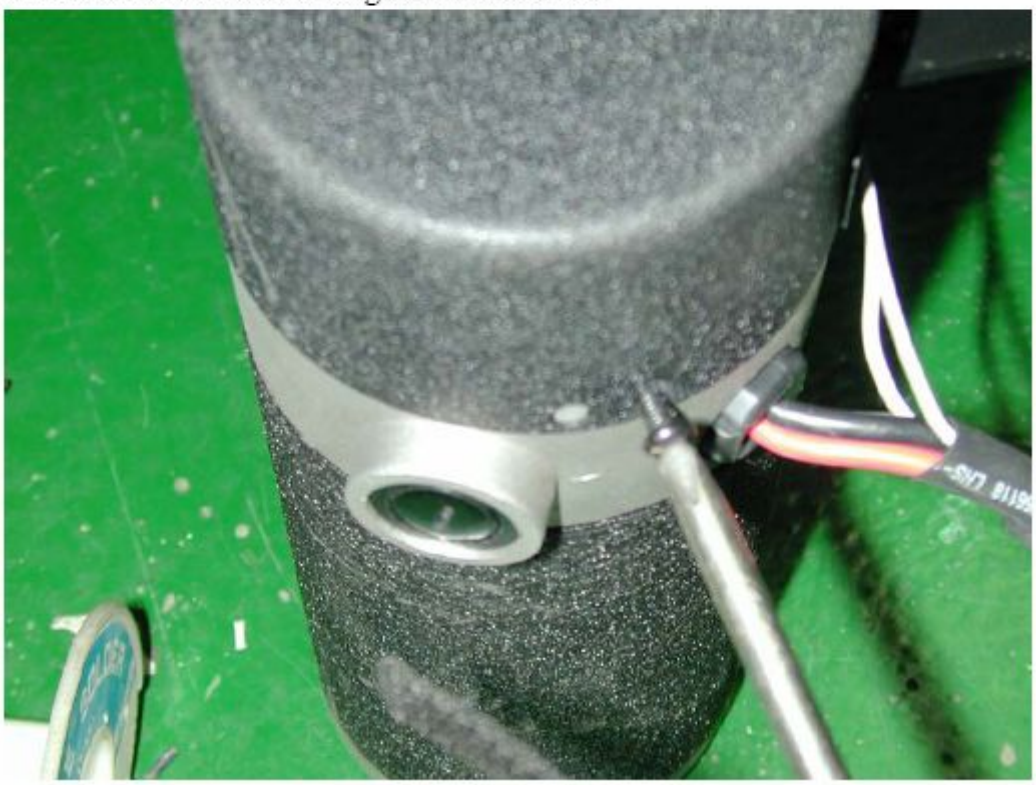
7.Tighten the 4 screws.



8. Solder the wires.(white wire to white wire, gray wire to gray wire)

9.Insulate the soldering point with heatshrink

10.Put the cover back and tighten the 2 screws.



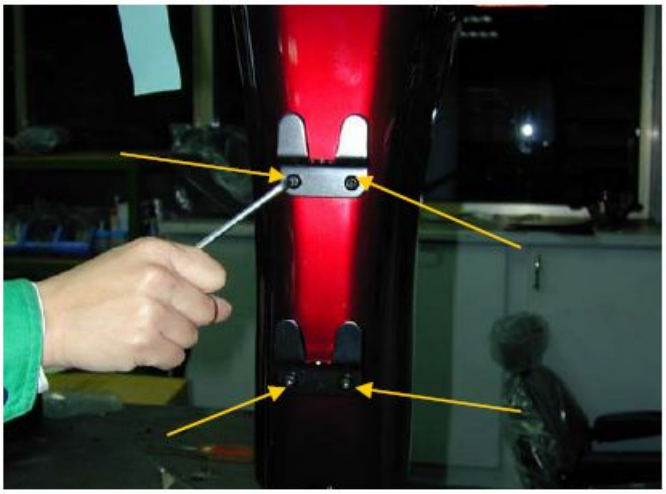
4. Tiller Instrument

In case tiller instruments are to be checked or replaced, tiller shroud must be dismantled first to allow access.

4.1Tiller disassembly/assembly procedure;

A. Tiller disassembly procedure:

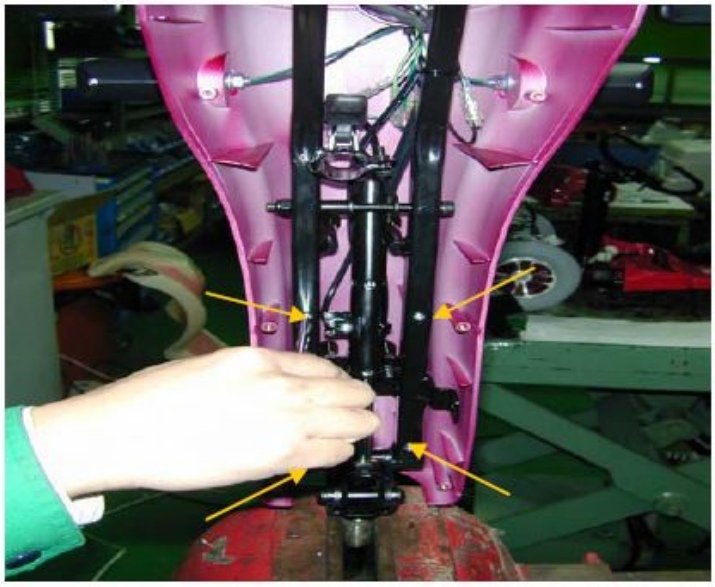
1. Loosen the four screws of basket hangers



2. Loosen the six screws of rear cover

3. Push down the lever and remove the rear cover

4. Loosen the four screws of front cover

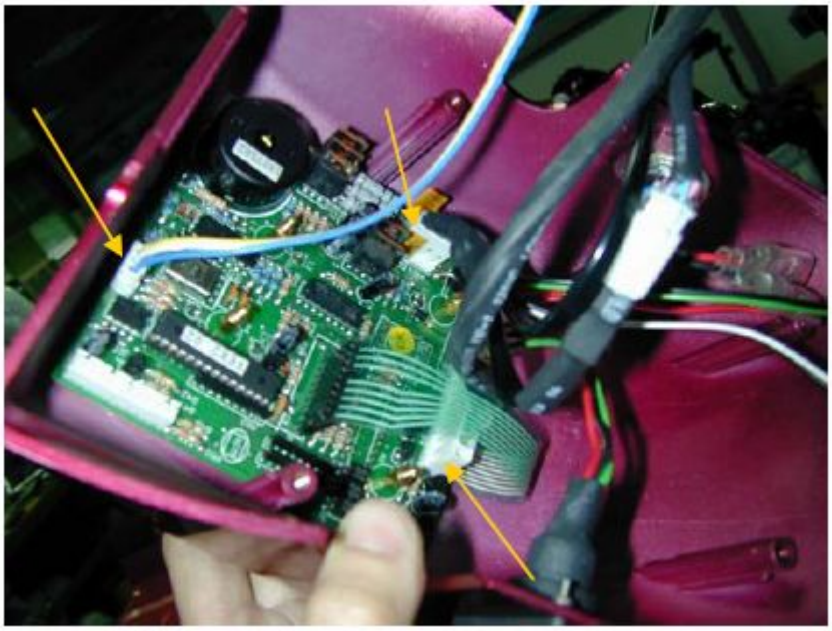


5. Remove the front cover

6. Unplug the lamp connectors (Note: right lamp wire
lamp wire color :white and black)

7. Loosen the four screws of top cover

8. Unplug the connectors:



B: Tiller assembly procedure:

You can just backward the disassembly procedure to assemble the tiller. Remember to tighten every screw and make sure every connector is plugged firmly.

4.2 Throttle Potentiometer(POT):

In some cases, scooter can not move results from POT problems. There are three typical POT problems.

1. Speed POT wire broken or short-circuited(Rhino flash code 7)

Check if wires shorted or connector loose.

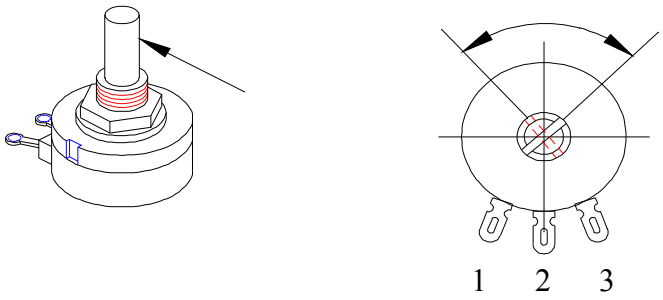
2. Speed POT out of range(Rhino flash code 7)

Measure the resistance between “1”and “3”of the potentiometer. It must be 5KΩ±10%. If not, Replace the potentiometer.

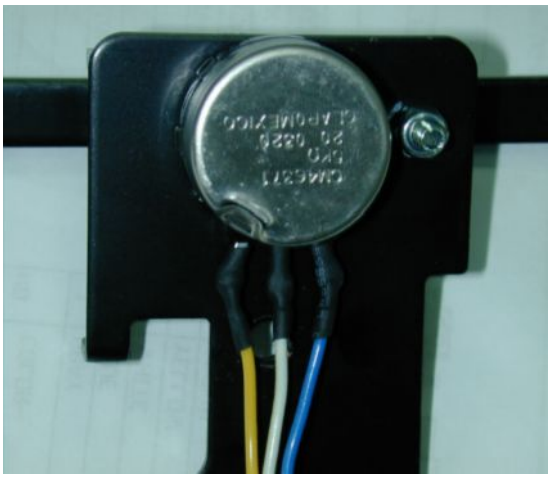
3.Speed POT not in neutral position(Rhino flash code 6)

Measure the resistance between “1”and “2”of the potentiometer. It must be 2.5KΩ±10%. If not, recalibrate the neutral position.

Measure the resistance between “2”and “3”of the potentiometer. It must be 2.5KΩ±10%. If not, recalibrate the neutral position.



Follow the wire color allocation--as picture below-- to solder the wire to the potentiometer.



4.3 Dash board PCB

Dash board handles all accessories of the scooter, like lighting system, buzzer, switches, battery gauge, charging inlet, keypad, speed adjust, throttle potentiometer. Sometimes the accessory problems may turn out to be caused by dash board PCB. Make sure all wires are not loose and all connector are connected firmly. If everything is fine but the problem still remains, replace the dash board PCB and test.

4.3.1 Analog dash board PCB

Following picture shows function of each connector on analog dashboard PCB.

1:Main cable connector
2:Key switch connector
3:Speed POT. Connector
4:Charger connector
5:Status LED connector
6:Hazard switch connector
7:Direction switch connector
8:Head light switch connector
9:Horn switch connector
10:Reduce speed switch connector
11:Turning reduce speed sensor connector
12:Lighting system connector
13. Speed adjust VR. Connector

4.3.2 Digital dash board PCB

1:Main cable connector

2:Key switch connector

3:Speed POT. Connector

4:Charger connector

5: Lighting system connector

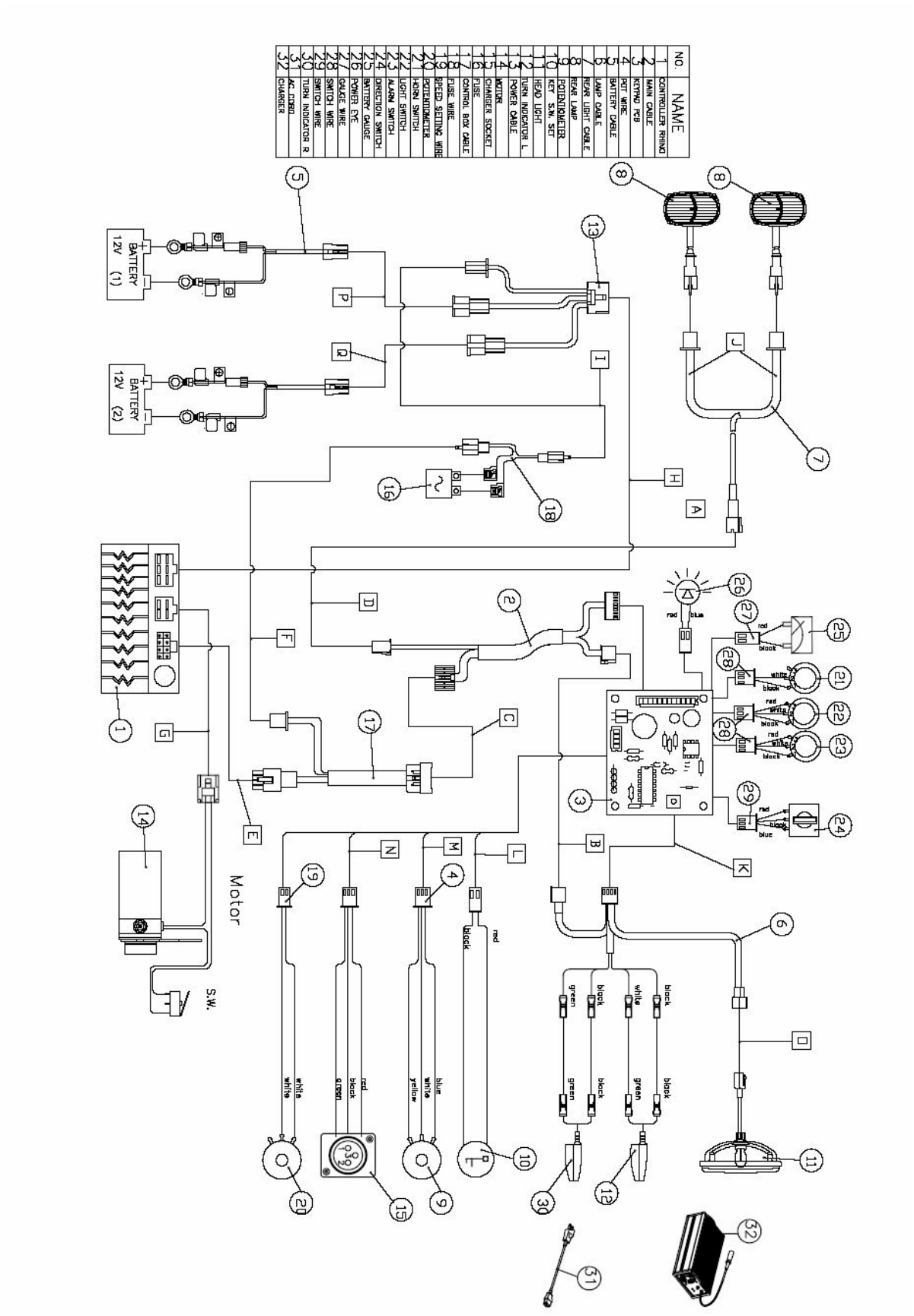
6:Key pad connector

7: Turning reduce speed sensor connector

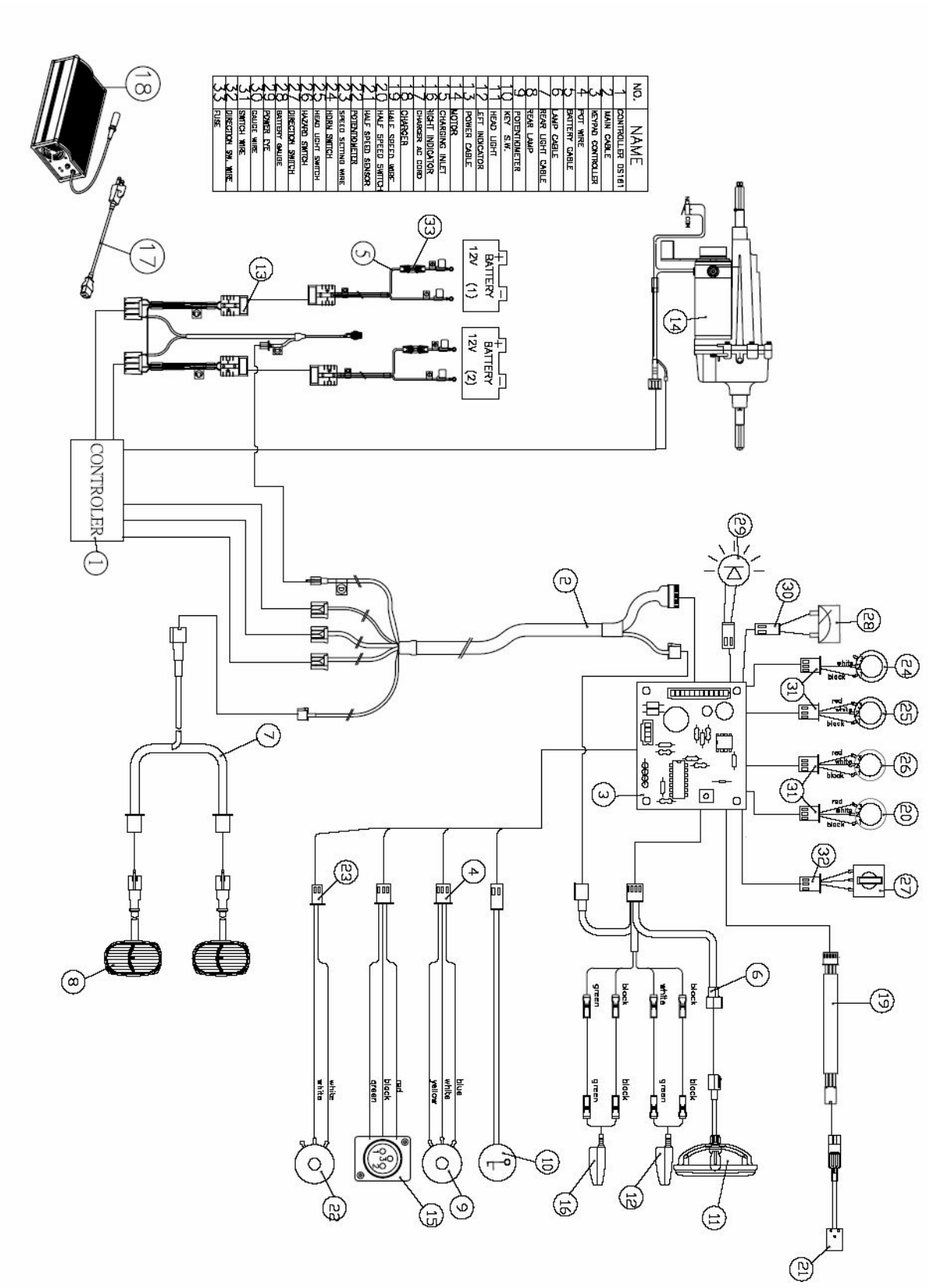
8: Reduce speed switch connector

5 Examples of electrical illustrated parts breakdown

5.1 S1-series scooter



5.2 S3-series scooter



6. Scooter troubleshooting ---Typical problems and solutions

Problem	Possible Causes	Solution
Scooter does not run (Scooter not moving and lights do not work using battery, but lights do work when you plug the charger into the scooter and also plug the charger into the wall outlet)	Undercharged battery	Charge the battery. A new battery should have been charged for at least 12 hours before using the vehicle for the first time and up to 8 hours after each subsequent use. Check all connectors. Make sure the charger connector is tightly plugged into the charging inlet, and that the charger is plugged into the wall. Make sure power flow to the wall outlet is on.
	Charger is not working	You may check to see if your charger is working by using a volt meter
	Burned out fuse	Replace the fuse.
Scooter does not run (Scooter not moving and lights do work using battery,)	Controller diagnostic (flashcode)	Follow controller section(Chapter 7.3.2) to see flashcode meanings and Solutions.
	Status LED fail	If status LED is dimly light or not working, replace with new one.
Scooter not moving and all lights do not work with only batteries.	Burned out fuse	Replace the fuse
	Loose wire/Connection	Check if wires/connections are tight.
Scooter was running but suddenly stopped	Controller trip	The controller will automatically shut off the power if the motor is overloaded. An excessive overload, such as too heavy a rider or too steep a hill, could cause the controller to overheat. If the scooter suddenly stops running, wait a few seconds and let the controller cool down.
	Tripped circuit breaker or burned out fuse	Check all wires and connectors to make sure they are tight. The circuit breaker or fuse will automatically shut off the power if overload or short-circuit happens. If the scooter suddenly stops running, push the breaker to reset the circuit

		or replace the fuse. Correct the conditions that caused the breaker/fuse to trip and avoid repeatedly tripping the breaker.
Short run time (less than usual per charge)	Undercharged battery	Charge the battery. A new battery should have been charged for at least 12 hours before using the scooter for the first time and up to 8 hours after each subsequent use. Check all wires and connectors. Make sure the charger plug is tightly plugged into the charging socket, and that the charger is plugged into the wall. Make sure power flow to the wall outlet is on.
	Battery is old and will not accept full charge	Even with proper care, a rechargeable battery does not last forever. Battery life depends on scooter use and conditions. Replace the battery if necessary.
	Hand brake is not adjusted properly	Adjust the handbrake neutral position to reduce the friction between brake disk and brake lining when brake is in neutral position.
Scooter runs sluggishly	Tires are not properly inflated	Make sure the tires have sufficient air but this usually is not the problem. The tires are inflated when shipped, but they will lose some pressure between the point of manufacturing and delivery. Check tire pressure and properly inflate the tires.
	Scooter is overloaded	Make sure you do not overload the scooter by carrying too much weight, going up a hill or towing objects behind the scooter. If the scooter is overloaded, the controller may go into protection mode and even shut off power to the motor. Correct the driving conditions that caused the overload, wait a few seconds, and then let the controller to recovery. Avoid repeatedly overloading the scooter.
	Hand brake is not adjusted properly	Adjust the handbrake neutral position to reduce the friction between brake disk and brake lining when brake is in neutral position.
	Battery problem	Battery needs to be recharged. If after full charging the

		batteries, the scooter still runs sluggishly. Replace the batteries. Sometimes, it may be too cold to operate the scooter. The battery does not output much current at low temperatures (below 5 degree C). It is too cold to operate.
Sometimes the scooter doesn't run, but other times it does	Loose wires or connectors Switch bad	Check all wires and all connectors to make sure they are tight. Check ON/OFF switch to make sure it is working properly.
Charger gets warm during use	Normal response to charger use	No action required. This is normal for chargers and is no cause for concern. If the charger does not get warm during use, it does not mean that it is not working properly.
Scooter can not stop on a slope	Magnetic brake are not working properly	Possibly the brake lining is worn out. Replace the magnetic brake.
Scooter takes off - will not stop	Throttle potentiometer problem	If the scooter is moving when you release the throttle , you will need to adjust the potentiometer neutral position or replace the throttle potentiometer.
After charging for 8 hours, the scooter battery gauge does not show a full charge	Charger Charger connection Battery	Charger may be bad. Replace charger. This is the most common. Charger connection on scooter is bad- usually a wire on the back of the charger socket is loose. Batteries are bad. Replace new ones
All lights work and scooter can move but the battery gauge does not work.	Loose wire/connection Battery gauge	Check if wire/connection is tight. Battery gauge is bad. Replace new ones.
Light is not working.	Bulb Loose wire/Connection Switch Dashboard PCB	Check /Replace light bulb. Check if wire/connection is tight. Check switch function, If bad, replace new one. If light bulb , wire connection and switch are all OK, Replace dashboard PCB.

7.Controller

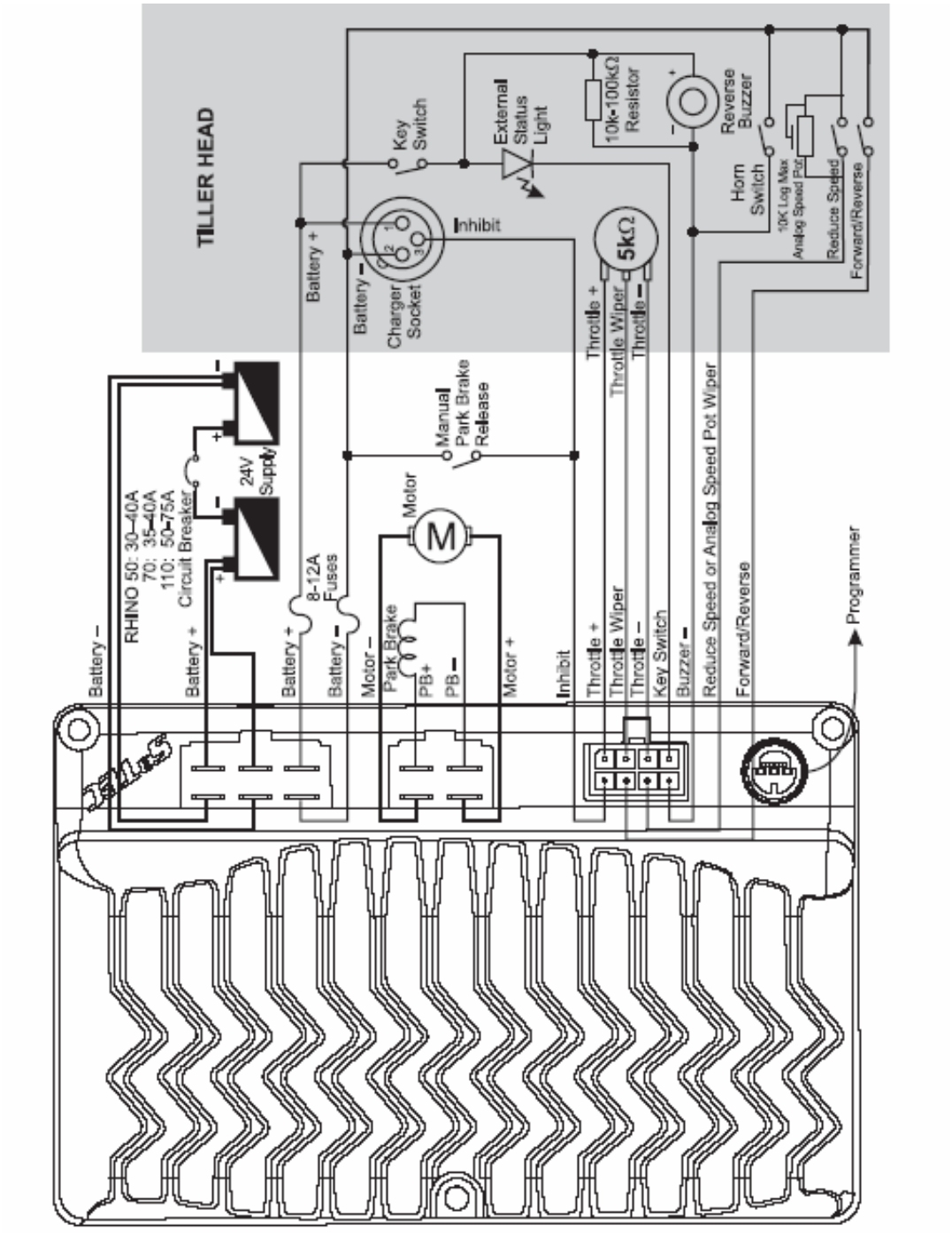
The Rhino Controller

The RHINO scooter controllers includes:
•70A model (DS72K) for small-to-medium-size scooters
•110A model (DS112K) for medium-to-large-size scooters
•160A model (DS162K) for large scooters

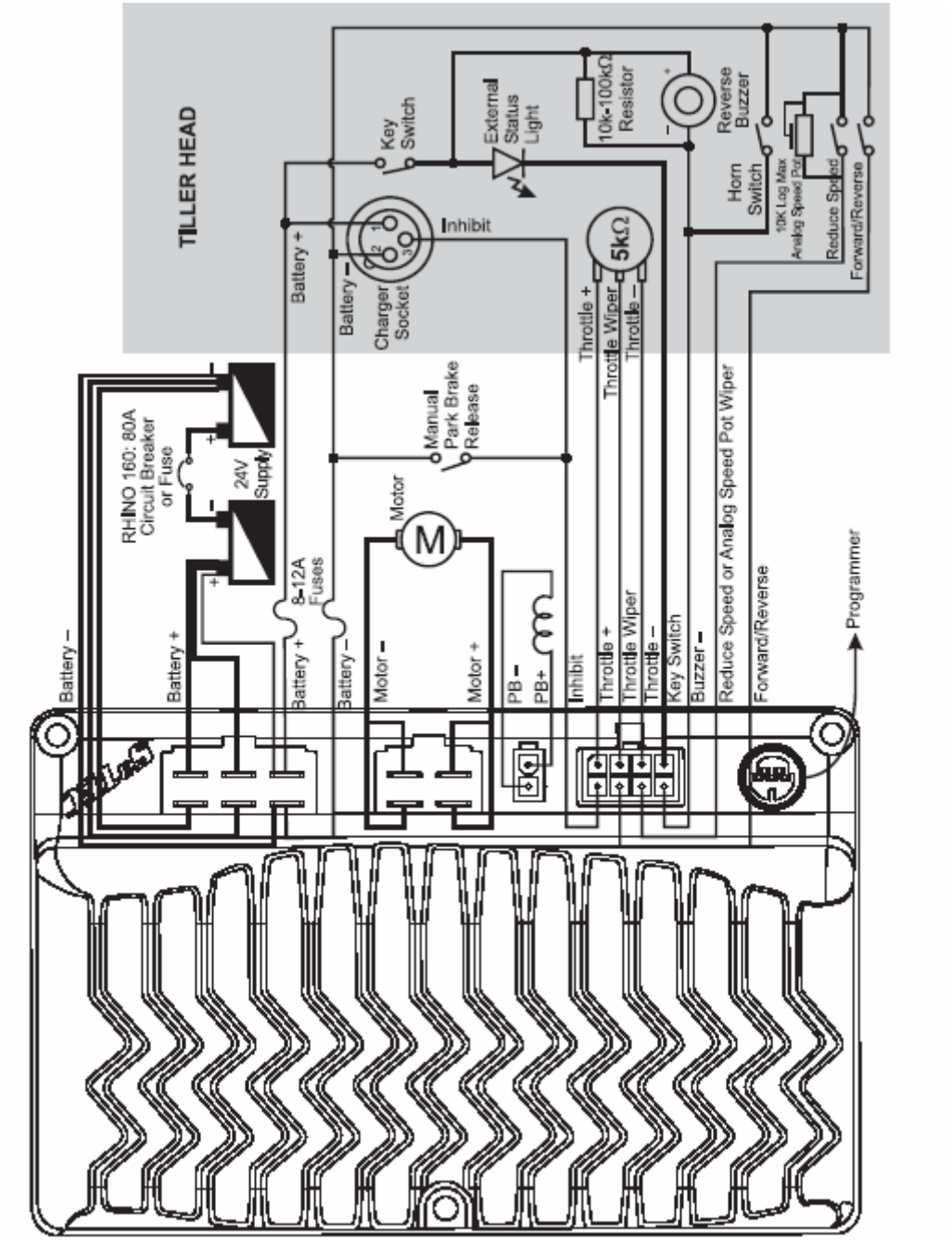
7.1 RHINO Connections and Wiring

RHINO connections are located along the front of the case. The illustration below indicates the different connectors and gives a section reference for specific installation instructions. When all wiring has been completed, it must be securely fastened to the scooter frame to ensure there is no strain on the connectors or any chance of snagging.

Before making any connections to RHINO, disable the scooter by one of the following means to prevent accidental movement or arcing:
1) place the battery circuit breaker in the open position, or
2) disconnect the batteries



Typical Wiring Diagram for RHINO DS52K, DS72K, DS112K

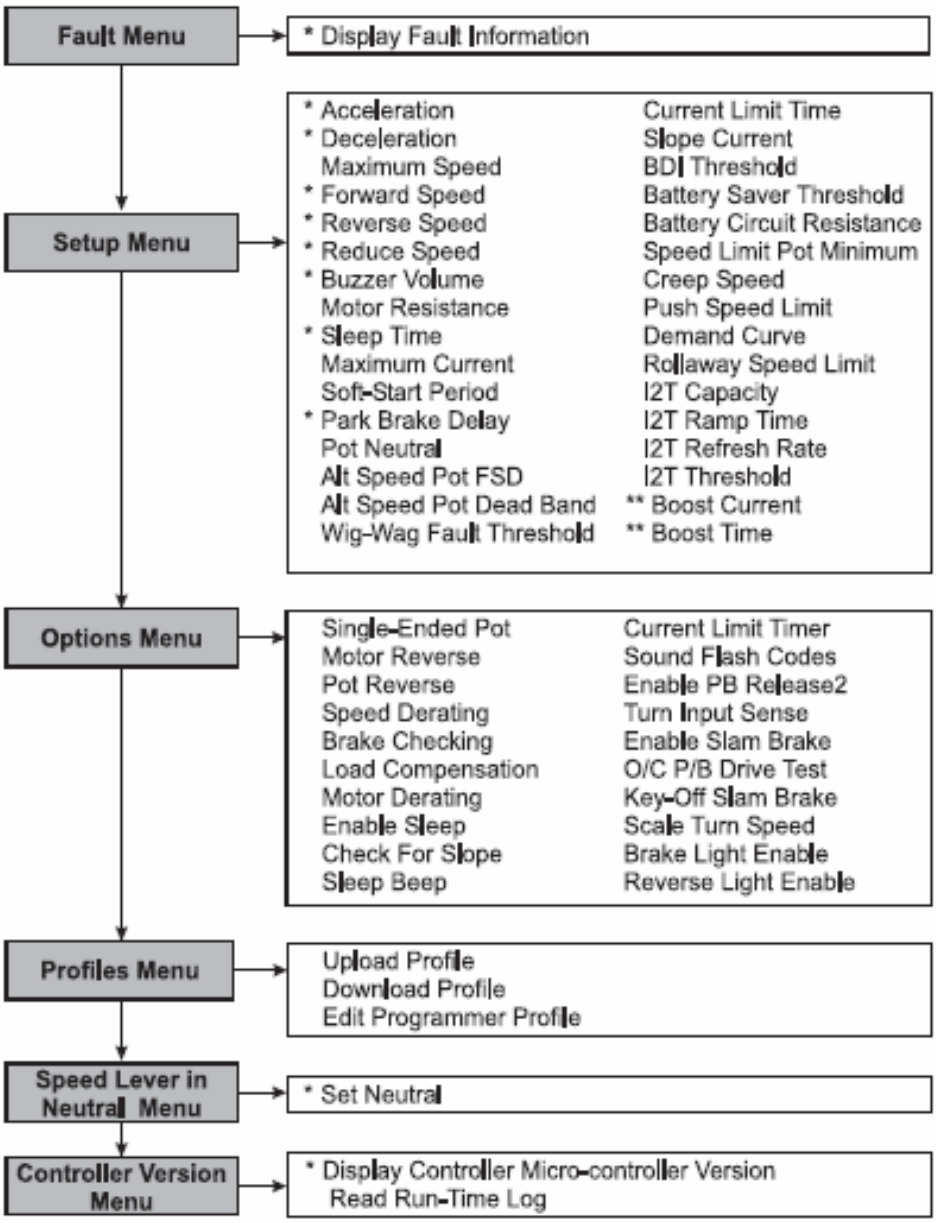


Typical Wiring Diagram for RHINO DS162K

7.2 Programming RHINO

Using a hand-held programmer DZ-DS-PM, the controller settings can be modified if desired.

DZ-DS-PM (Manufacturer Version) Programmer Tree



* Parameters available to DZ-DS-PD

** DS162K Only

RHINO Programming

Warning :

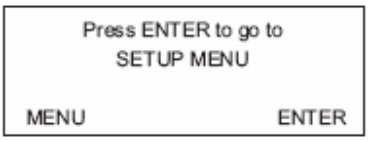
Only qualified personnel should make alterations to RHINO programming. Incorrect or inappropriate programming of RHINO can put the scooter into a dangerous state. Manufacturer accepts no responsibility or liability for accidents caused by incorrect programming. On completion of programming, we recommend a drive test be carried out to ensure performance is as desired.

Note :If the scooter is turned off during programming, any changed settings

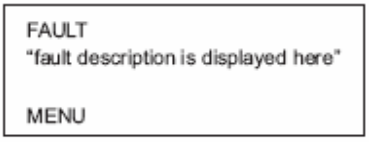
are not saved and RHINO defaults back to the previously programmed settings.

1. With the scooter turned on, plug the programmer into the RHINO programming socket. The startup screens appear for two seconds.

The display then changes to the Main Menu screen.



If the scooter currently has a fault, pressing the MENU button displays the Fault Menu screen.



2. Press MENU to return to the Main Menu.
3. Press MENU while in the Main Menu screen to cycle through the available menus.

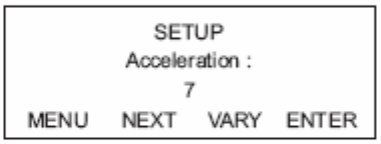
Setup Menu	Allows the scooter to be customised for the user's driving preferences or environment.
Options Menu	Allows the scooter manufacturer to optimise RHINO for a particular scooter model. Can only be changed with a Manufacturer version Programmer.
Profiles Menu	Allows the editing, uploading and downloading of scooter profiles. (Available on Manufacturer version only.)
Speed Lever in Neutral Menu	Allows calibration of the throttle about neutral.
Controller Version Menu	Gives controller version information.

4. Select the required menu and press ENTER. The selected menu screen is displayed.

Setup and Options Menus

The procedure for modifying settings in the Setup Menu and Options Menu is the same, as outlined below.

1. While in the Setup or Options Menu, press NEXT to cycle through the available settings.



2. Press VARY to change the value of the currently selected setting.
3. Press ENTER to confirm the new value.
4. On completion of programming, unplug the programmer to save the new information to the controller.
5. Wait until the controller status light comes on (about two seconds) before turning the scooter off.

Programmable Settings

The following settings can be modified so that a scooter can meet user's needs. Not all of these settings are available from the Scooter Programmer.

7.2.1 Setup Menu

These settings customize the scooter to user preferences and/or environment.

Setting	Description	Values	
Acceleration	Sets the acceleration of the scooter. The higher the setting, the greater the acceleration rate. A low acceleration gives "softer" performance and a less sensitive throttle response.	1 10 **3** Yes Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Deceleration	Sets the deceleration of the scooter. The higher the setting, the greater the deceleration rate. Low settings should only be used with very low **Forward Speed** settings. This should be set higher than the **Acceleration** parameter.	1 10 7 Yes Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Maximum Speed	Allows fine adjustment of the RHINO controller's maximum motor output, and thus of the motor's maximum speed. (Usually set to meet local regulatory requirements.)	127 255 **255** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Forward Speed	Sets the maximum forward speed of the scooter. The higher the setting, the higher the maximum forward speed.	1 10 **10** Yes Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Reverse Speed	Sets the maximum reverse speed of the scooter. The higher the setting, the higher the maximum reverse speed. Anti-tip wheels may be required if high **Reverse Speed** settings are used.	1 10 **4** Yes Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**

Setting	Description	Values	
Reduce Speed	Limits the maximum forward speed and maximum reverse speed of the scooter. For example, if **Reduce Speed** is set to 7, **Forward Speed** to 10 and **Reverse Speed** to 6, maximum forward speed will reduce to 7, but maximum reverse speed will stay at 6, as it is already lower than **Reduce Speed.**	1 10 **5** Yes Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Buzzer Volume	A setting of 1 turns the reversing buzzer off. Any other value enables the reversing buzzer with full volume.	1 10 **10** Yes Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Motor Resist-ance	Indicates the resistance of the motor to which RHINO is connected. A correct value for this setting is required to achieve good speed regulation.	5mΩ 255mΩ **60mΩ** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Sleep Time	Sets the length of time with no throttle movement before RHINO goes into Sleep Mode. When in Sleep Mode, the Status Light turns OFF and the scooter will not respond to commands. To exit Sleep Mode, turn the power off, then on again. Refer to **Enable Sleep** in the Options Menu for information about the Sleep Mode feature.	5 min. 60 min. **30 min.** Yes Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Maximum Current	Sets the maximum output current from RHINO to the motor. Lower values can affect scooter performance. The maximum useable setting corresponds with the nominal current output for the controller type i.e. 50A for the DS-52K. Higher settings than the controller is capable of have no effect on the maximum current rating.	30A 160A **70A** No Yes	**Minimum** **Maximum** **Default, DS72K** **Dealer Prog?** **HHP?**

Setting	Description	Values	
Soft-Start Period	Can be used to soften the initial "take off" when the throttle is moved out of neutral. Set the length of time in steps of 16 milliseconds at which acceleration will be 50% of the maximum when starting from neutral. (The factory setting generally gives the best performance.)	0 200 **50** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Park Brake Delay	Sets the time between the scooter coming to a stop and the park brakes engaging. Too high a value can cause excessive "creep back" when stopping on a slope, too low a value can cause the scooter to lurch when stopping. The factory default generally provides the best performance. If the **Check for Slope** setting in the Options Menu is set to ON, this setting is ignored.	1 30 **6** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Pot Neutral	Sets the neutral position of the throttle. Care should be taken when changing this setting otherwise eratic operation may result if the throttle wiper becomes detached.	102 180 **128** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Alternative Speed Pot FSD (Full-Scale Deflection)	Sets the throttle position at which the RHINO reaches maximum speed. If set too high, the scooter will not achieve maximum speed no matter how much the throttle is deflected. If set too low, the scooter will reach maximum speed with only a small deflection of the throttle.	30 127 **72** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Alternative Speed Pot Dead Band	Sets the amount the throttle must be deflected before the scooter begins to drive.	5 63 **20** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**

Setting	Description	Values	
Wig-Wag Fault Threshold	Controls the threshold at which the controller will generate a fault if a short exists between the Wig-Wag potentiometer wiper and either end terminal. Use values greater than 10 if ISO resistors are fitted.	10 63 **10** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Current Limit Time	If RHINO is in current limit for this amount of time driving will be disabled and a Flash Code 4 displayed. The scooter must be turned off, then on again to reset. The **Current Limit Timer** in the Options menu must be set to ON for this setting to have any effect.	5 50 **15** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Slope Current	Sets the threshold at which the park brakes will be applied when the **Check for Slope** setting is set to ON.	5 100 **20** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
BDI Threshold	Sets the threshold at which the Battery Discharge Indicator (BDI) shows a low battery.	21.0 26.0 **23.3** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?**
Battery Saver Threshold (V)	Sets the voltage at which the Battery Saver feature becomes active. This feature protects the batteries by slowing the scooter as the voltage decreases, thereby extending battery life. Setting this to a higher value will cause the scooter to activate the Battery Saver feature earlier, providing additional battery protection but limiting scooter performance particularly on slopes. Setting this to a lower value will cause the scooter to continue to perform optimally for longer but may shorten battery life.	128 165 **146** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**

Setting	Description	Values	
Battery Circuit Resistance (mOhm)	If the resistance of the battery circuit is entered, the controller will be able to calculate a far more accurate battery voltage used in features such as the Battery Saver.	0 50 **0** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Speed Limit Pot Minimum	Limits the maximum forward and reverse speed of the scooter. If Digital Pot implementation is used, the **Reduce Speed** setting determines the reduce speed parameters. If Analog Pot implementation is used, **Speed Limit Pot = ON** allows the **Reduce Speed Switch** to let the speed limit potentiometer control the scooter speed. Must be set to 255 if no speed reduction pot is fitted.	51 255 **51** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Creep Speed	Increases the amount of throttle movement required before the park brakes will disengage. Helps to prevent rollback on slopes.	0 20 **20** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Push Speed Limit	If RHINO is turned on and the park brakes have been electrically released using the Park Brake Release lever, the speed at which the scooter can be pushed will be limited to this value. If the Push Speed is exceeded, the scooter will execute a controlled stop.	20 100 **100** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**
Demand Curve	Defines the scooter response to throttle movement. If set to 0%, moving the throttle half of its travel will result in the scooter travelling at half its programmed speed. If set to 100%, moving the throttle half of its travel will result in the scooter travelling at around 25% of its programmed speed, increasing speed as the throttle is moved further.	0 100 **80** No Yes	**Minimum** **Maximum** **Default** **Dealer Prog?** **HHP?**

7.2.2 Options Menu

These settings are adjustable using a hand held programmer. Settings via the programmer can be either ON or OFF.

Setting	Description	Default
Single-Ended Pot	If ON, the throttle controls speed only, and direction is selected with a forward/reverse switch. If OFF, speed and direction are controlled by the throttle. No forward/reverse switch is required. For the DS72KA, this option should be OFF otherwise the actuator function will be unavailable.	**OFF**
Motor Reverse	If ON, the polarity of the motor pins on the motor connector is reversed, and the motor turns in the direction opposite to normal.	**OFF**
Pot Reverse	If ON, the polarity of the throttle is reversed. Moving the throttle in the direction that normally causes forward movement results in reverse movement. When used with **Single-Ended Pot = ON**, this option will reverse the directions of the Forward/Reverse switch.	**OFF**
Speed Derating	Enables the Reduce Speed option on the Setup Menu.	**ON**
Brake Checking	Set to ON if the motor has a park brake.	**ON**
Load Compen-sation	Allows RHINO to maintain a constant speed despite changing driving conditions (for example, climbing from a flat surface on to a slope). This setting should be ON for normal operation. It uses the **Motor Resistance** setting in the Setup Menu.	**ON**
Motor Derating	This option is set to ON.	**ON**
Enable Sleep	If ON, Sleep Mode is enabled, and RHINO goes to 'sleep' after the **Sleep Time** specified with the Setup Menu.	**ON**
Check for Slope	If ON, stopping performance tends to be harsher than normal. The **Park Brake Delay** setting in the Setup Menu is bypassed when stopping on a slope.	**OFF**
Sleep Beep	If ON, RHINO will beep three times when it goes into Sleep mode.	**ON**

Setting	Description	Default
Current Limit Timer	Having this setting turned ON is a regulatory requirement in some countries. If ON, RHINO will automatically stop driving after the amount of time set in the **Current Limit Time** setting. Flash Code 4 is displayed and the scooter must be turned off, then on again, to reset. When set to ON, RHINO might turn off after a time under heavy load (for example, going up a long, steep hill). This will be undesirable for some users. If driving resumes before the motor cools, or if this option is turned OFF, the motor might be damaged under a heavy load.	**ON**
Sound Flash Codes	If ON, RHINO will also signal Flash Codes with the buzzer.	**ON**
Enable PB Release2	If ON, the Forward/Reverse switch can be used as an alternative park brake release switch. This parameter is not available on the DS72KA.	**OFF**
Turn Input Sense	If ON, when the controller senses the Mode Select switch is Open, **Reduce Speed** mode will be entered. If OFF, the **Reduce Speed** mode will be entered when the controller senses the Mode Select switch is Closed.	**OFF**
Enable Slam Brake	If ON, moving the throttle significantly in the opposite direction to which the scooter is currently moving causes the scooter to decelerate immediately at its maximum deceleration rate (as per the **Deceleration** setting).	**ON**
O/C P/B Drive Test	RHINO checks the park brakes for open circuits before and while driving. In some circumstances the park brake checking during driving may result in audible noise and/or incorrectly generates faults. Set to OFF only if necessary.	**ON**
Key-Off Slam Brake	If ON, a driving inhibit condition (typically removal of the key) will cause the scooter to decelerate immediately at its maximum deceleration rate (as per the **Deceleration** setting). If set to OFF, the scooter will slow at its normal deceleration rate (controlled stop).	**ON**
Scale Turn Speed	If ON and the scooter is in **Reduce Speed** mode, the speed of the scooter will operate as described in the **Reduce Speed** setting. If OFF and the scooter is in **Reduce Speed** mode, the speed (both forward and reverse) will always be limited to the **Reduce Speed** setting. Set to OFF if the input is from a speed limit input such as a steering sensor, slope sensor or seat position switch.	**OFF**

7.2.3 Common Programming Errors

Sometimes after changing certain parameters, in particular, when customizing the Motor Reverse and Pot Reverse settings, the scooter might not drive in the way that was intended. Following is a matrix of Motor Reverse and Pot Reverse

settings and the impact they have on the motion of the scooter.

Setting		Result	
Motor Reverse	Pot Reverse	Driving Forward	Driving Backward
OFF	OFF	Fast forward speed	Slow reverse speed with buzzer
ON	OFF	Fast reverse speed	Slow forward speed with buzzer
OFF	ON	Slow reverse speed with buzzer	Fast forward speed
ON	ON	Slow forward speed with buzzer	Fast reverse speed

7.3 RHINO Diagnostics & Fault Finding

RHINO provides diagnostics information to assist technicians with diagnosing and correcting faults within the scooter system. A fault in the scooter will cause the RHINO Status Light to flash separated by a pause. The number of flashes in each burst, also referred to as the *flash code,* indicates the nature of the fault. Depending on the severity of the fault and its impact on user safety, RHINO will react differently. It can:

• Display the flash code as a warning but allow normal driving and operation.
• Display the flash code as a warning but allow limited driving and operation.
• Display the flash code, stop the scooter and prevent driving until the scooter has been turned off and then back on again.

Descriptions of what each flash code means can be obtained by plugging in the RHINO programmer. Detailed descriptions of what each flash code means and the probable cause and remedy for each are described in flash code table .

7.3.1 Diagnosing RHINO Faults

Use the following troubleshooting guide if the scooter fails to operate. The guide will help identify whether the fault exists within RHINO or another part of the scooter system.

Required equipment: Voltmeter

Note: Elevate the drive wheels before carrying out the following tests. Turn the key switch on before beginning any diagnostics. The voltages shown are nominal values.

Warning:

Testing should only be carried out by qualified service personnel.

If the External Indicator Light is PERMANENTLY ON, but the scooter does not move

Check that the park-brake solenoid or relay is working.

Move the throttle to the full-speed position and listen carefully for the operation of the park-brake solenoid or the relay in the RHINO.

- If you can hear the solenoid or the relay, the problem is not with the throttle or the inhibit circuitry.
- If you can hear the solenoid but the motor does not turn, look for an open circuit in the motor wiring.

Check the voltages on the Throttle terminals with the throttle in neutral.

Connect a voltmeter between Battery – and the following Throttle pins:

Battery – » Throttle – 0.5 ± 0.1V
Battery – » Throttle Wiper 2.5 ± 0.1V
Battery – » Throttle + 4.5 ± 0.1V

When the Throttle is moved in the forward and reverse directions, the voltage on Throttle Wiper should increase and decrease by 2V.

- If the throttle voltages are incorrect, an incorrect throttle potentiometer is being used and/or it is not correctly calibrated.
- If the voltage swing does not occur, check the potentiometer and wiring for open circuits.

Check the voltages on the Motor terminals.

Connect a voltmeter between Motor + and Motor –.

The voltmeter should measure 0V when the throttle is in neutral.
The voltmeter should measure 24V as the throttle is moved out of neutral to full forward.

- If the voltage out of neutral is above 0V but the motor is not driving, check the motor, motor wiring, and connectors.

Check the voltages on the Park Brake terminals.

Connect a voltmeter between Park Brake + and Park Brake –.

The voltmeter should measure 0V when the throttle is in neutral.
The voltmeter should measure 24V when the throttle is out of neutral.

- If the voltages are incorrect, check the park brake and park brake wiring.

Check inhibit status.

Connect a voltmeter between Inhibit and Battery –.

The voltmeter should measure 5V.

- If the voltage is 0V, check that an inhibit switch is not engaged (e.g., from a battery charger). When 0V is applied to this terminal, driving will be inhibited.

If the Status Light is OFF

Check whether the RHINO Programmer is plugged in.

The status light will be out, and driving is not enabled when a Programmer is plugged in to the RHINO.

Confirm that the battery supply voltage is present on the RHINO Battery +/– terminals.

Connect a voltmeter between Battery + and Battery –, negative probe on Battery –.

The voltmeter should measure between 23 and 27 volts.

- If the voltage is negative, check for correct battery wiring polarity.
- If the voltage is 0V, check the circuit breaker and for open circuit wiring.

Confirm that the key switch is on and that its wiring and fuses are intact. Confirm that the Status LED, if present, is fitted correctly.

Connect a voltmeter between the Key Switch terminal and Battery –.

The voltmeter should read at least 20 volts.

- If the voltage is 0V, use the voltmeter to check the wiring from Battery + to the key switch itself and back to the Key Switch terminal.

If the External Indicator Light is FLASHING

Count the number of flashes and refer to the following section, RHINO Flash Codes.

Plug in the RHINO Programmer to determine the cause of the fault.

7.3.2 RHINO Flashcodes

Flash Code/Fault	Impact on Scooter	Notes
1 Battery needs recharging	Will drive	Battery charge is running low. Recharge the batteries as soon as possible.
2 Battery voltage too low	Drive inhibited	Battery charge is empty. Recharge the batteries. If the scooter is left off for a few minutes, battery charge might recover enough to allow driving for a short time.
3 Battery voltage too high	Drive inhibited	Battery charge is too high. If a charger is plugged in, unplug it or turn the Charge/Run switch to Run. Scooters powered by RHINO charge the batteries when travelling down slopes or decelerating. Excessive charging in this manner can cause this fault. Turn the scooter power off then on again. If necessary, reduce speed when descending the slope.
4 Current limit time-out	Drive inhibited	The scooter has drawn too much current for too long, possibly because the motor has been over-worked, jammed or stalled. Turn the scooter power off, leave for a few minutes, and then turn the power back on again. The controller has detected a shorted motor. Check the loom for shorts and check the motor. Contact your service agent.
5 Brake fault	Will Drive	The Park Brake Release switch has been turned on when powering up the scooter or while driving. Check the park-brake release lever is in the engaged position. Check the Park brake Release switch is closed when powering up.

Flash Code/Fault	Impact on Scooter	Notes
5 Brake fault	Drive inhibited	The park-brake coil or wiring is faulty. Check the park-brake and wiring for open or short circuits. If necessary, unplug the motor connector and check that all pins are in the correct position. If this flash code does not appear until the throttle has been moved out of neutral, check for a short in the park-brake circuit. If this flash code appears at power-up, check for an open circuit in the park-brake circuit. Contact your service agent.
6 Out of neutral at power-up	Drive inhibited	Throttle is not in neutral position when turning key switch on. Return throttle to neutral, turn power off, and back on again. Throttle may need to be adjusted (see Section 4.2.3). Check throttle wiring.
7 Speed Pot error	Drive inhibited	The throttle, speed limit pot or their wiring may be faulty. Check for open or short circuits. The throttle or speed limit pot may not be correctly set up. If no speed limit pot is fitted, the Speed Pot Limit parameter must be set to 255. Contact your service agent.
8 Motor volts error	Drive inhibited	The motor or its wiring is faulty. Check for short circuits. Contact your service agent.
9 Other internal errors	Drive inhibited	Contact your service agent.
10 Push Too Fast fault	Drive inhibited	The scooter has been pushed faster than the programmed 'Push Speed' parameter when the Park Brake Release function has been operated. The scooter has been pushed faster than the programmed "Rollaway Speed" parameter when the Park Brake has been mechanically released. Turn the scooter off and then back on again.

8.CHARGER(HP8204B)

8.1 Operating Instruction

(1) To select the input voltage (115V/230V) and make a correct option by 115/230V option switch.

(2) To assure the charged batteries are lead acid batteries.
(3) To keep the AC power switch in "off " position before the charge circuitry and battery have been connected completely.
(4) To check if the output end of charger corresponds with the positive/negative pole of battery.
(5) After the above sequences have been finished, please turn on the AC power switch to "I" and the fan will begin to run. When LED turns red/yellow, it means the charger has been under normal charging condition (If the abnormal phenomena occurs, please turn off the charger immediately and check the 1~4 sequences repeatedly, then turn on the charger again.)
(6) When LED turns to red/green, that means the batteries have been finished for complete charge.
(7) Under the condition of yellow/green LED. It may have a temporary alternating phenomenon around 1~60 seconds during switching, please note this is a normal feature.

8.2. LED Indication

LED (POWER)-RED LIGHT ON: Power On
LED (CHARGE)-LIGHT OFF: Battery Disconnect
YELLOW LIGHT ON: Charging
GREEN LIGHT ON: Full-Charged

8.3 Troubles Shooting

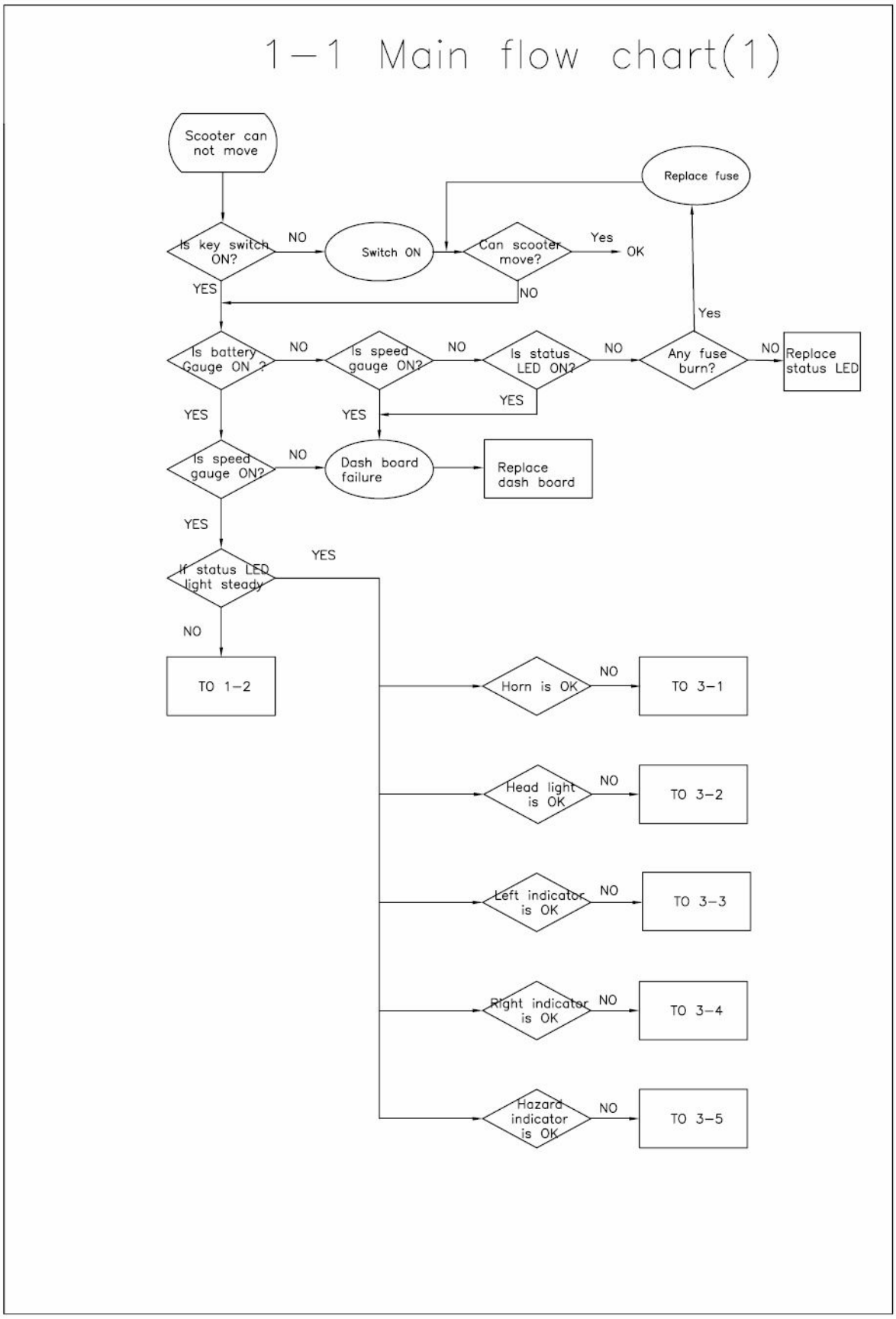
(1) When the power switch sites "on" but no LED light up:
To check the connection of power cord
To check the connection of socket.
To check if the fuse is under normal condition.
(2) When the power switch sites "on" but red/yellow LED do not light up completely and the fan does not run:
To check if the output wire occurs short circuit
(3) When the power switch sites "on", red LED light up, but green LED flashes and no charging action:
To check if the output fuse has severed
To check the connection between output connector and the battery
To check if having made a correct connection for the battery polarity.
To check the battery is connected completely.
(4) If the fuse is burned-out as soon as the power switch has been turned on and no effect at all:
After having been replaced with another new/same fuse. Please do not dismantle

the charger or replace with other larger fuse by yourself.
(5) The charge time continues for a long duration(abnormal):
To check if the battery has been broken down or aged
(6) The yellow/green LED have flashed over 40 minutes during charging:
To check if the battery is broken down
(7) The battery heats(abnormal):
To stop charging and check if there are troubles occurred on the charger

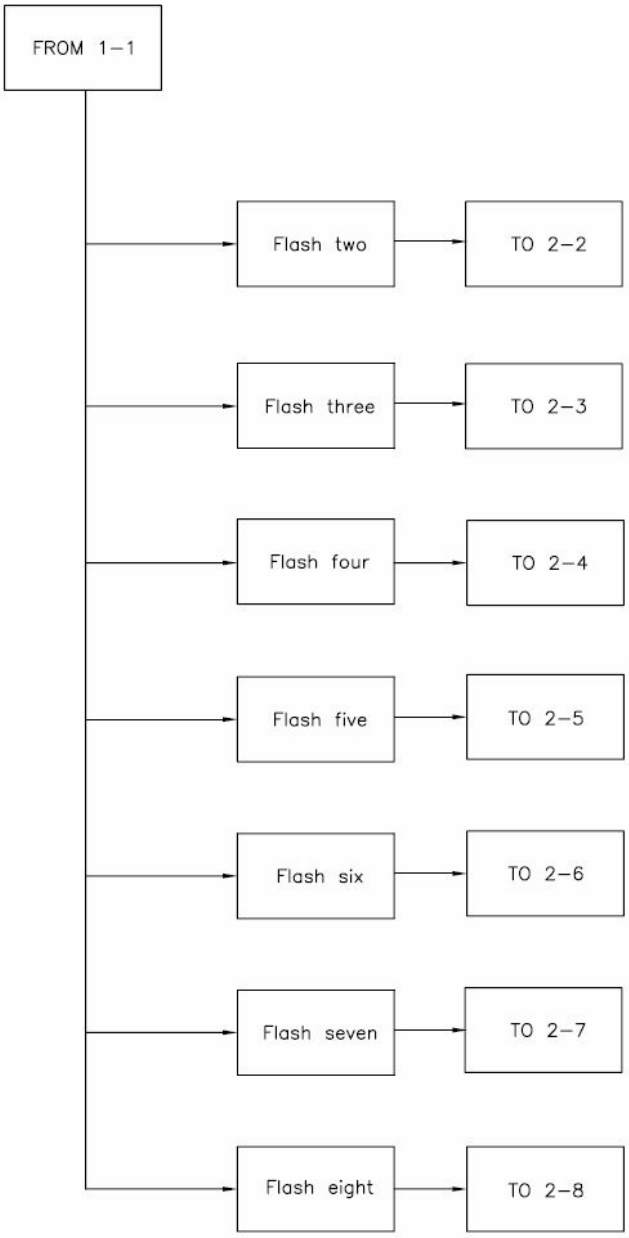
Caution

(1) If there is a ground wire for the power cord of charger, for safety purpose, please be sure to make a good ground connection job.
(2) To make sure the DC output corresponding with the battery which will be charged and the voltage value, otherwise, it may cause battery explosion and hurt someone.
(3) To keep the power on/off switch in "o" position before the charge circuitry and battery have been connected completely.
(4) Do not expose the charger to the rain, water or store it at humid place.

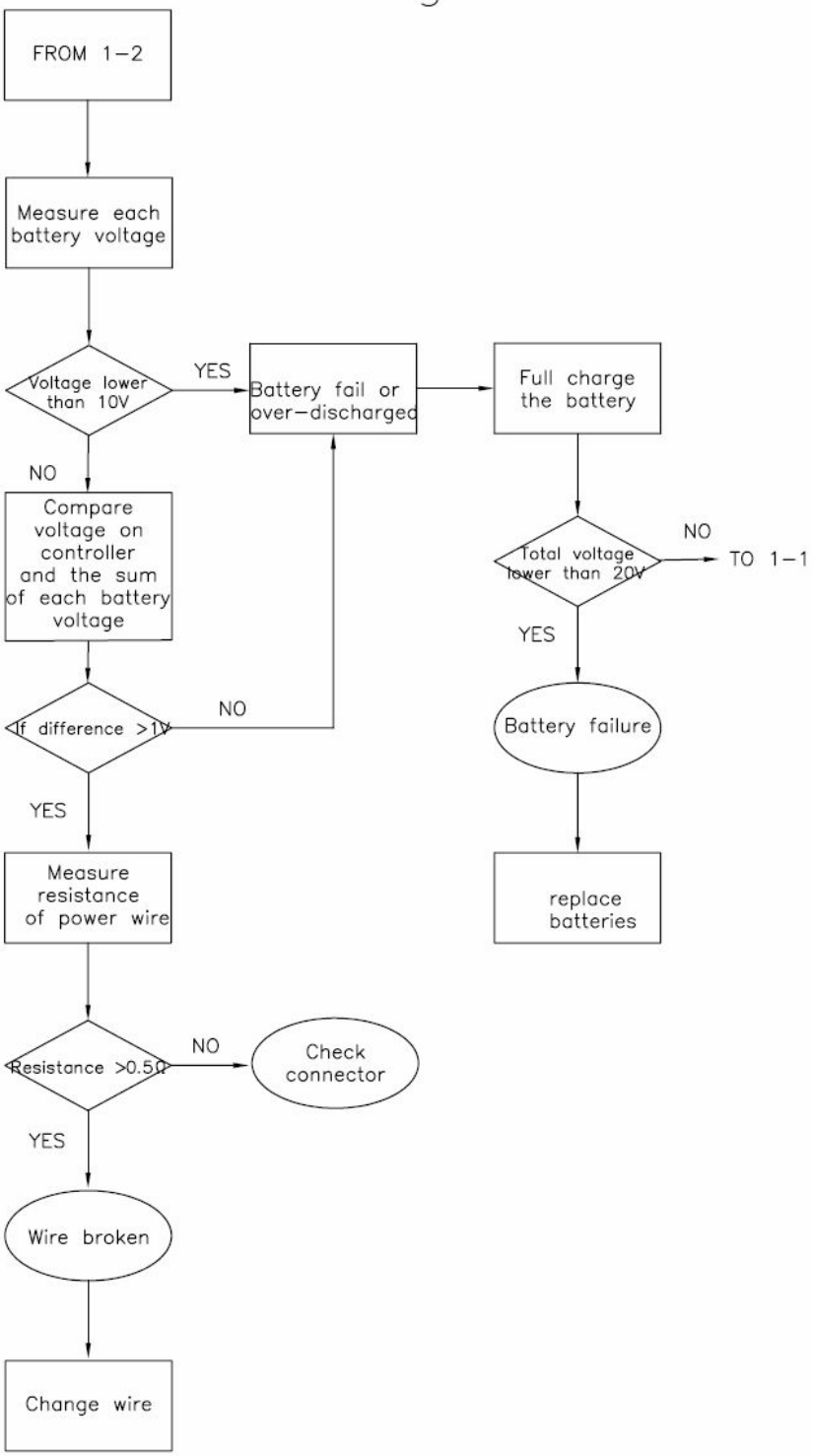
9. Diagnostic flow Chart



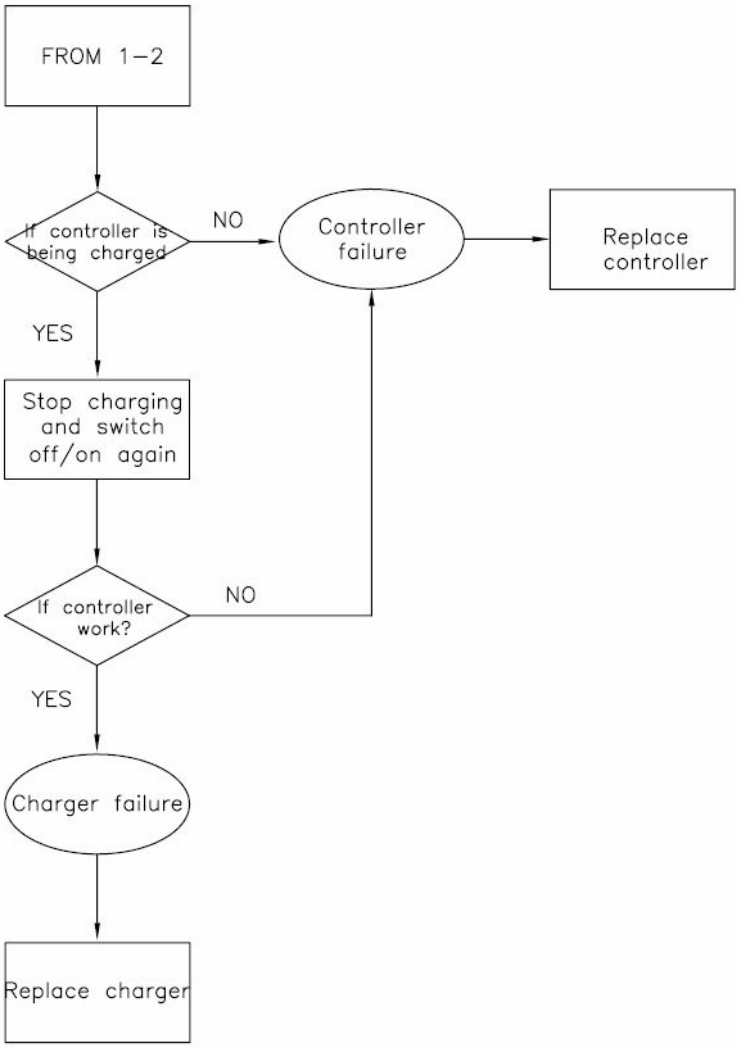
1－2 Main flow chart(2)



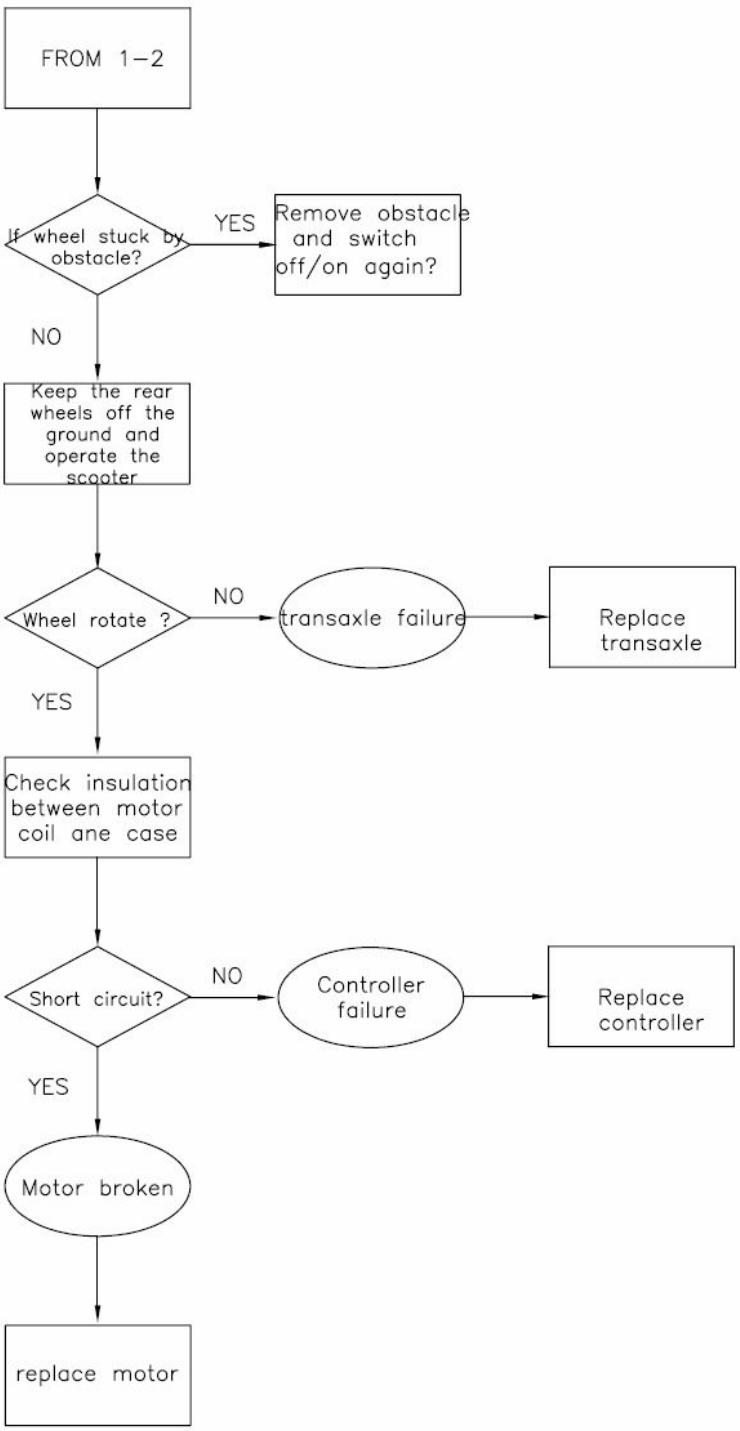
2-2 Voltage too low



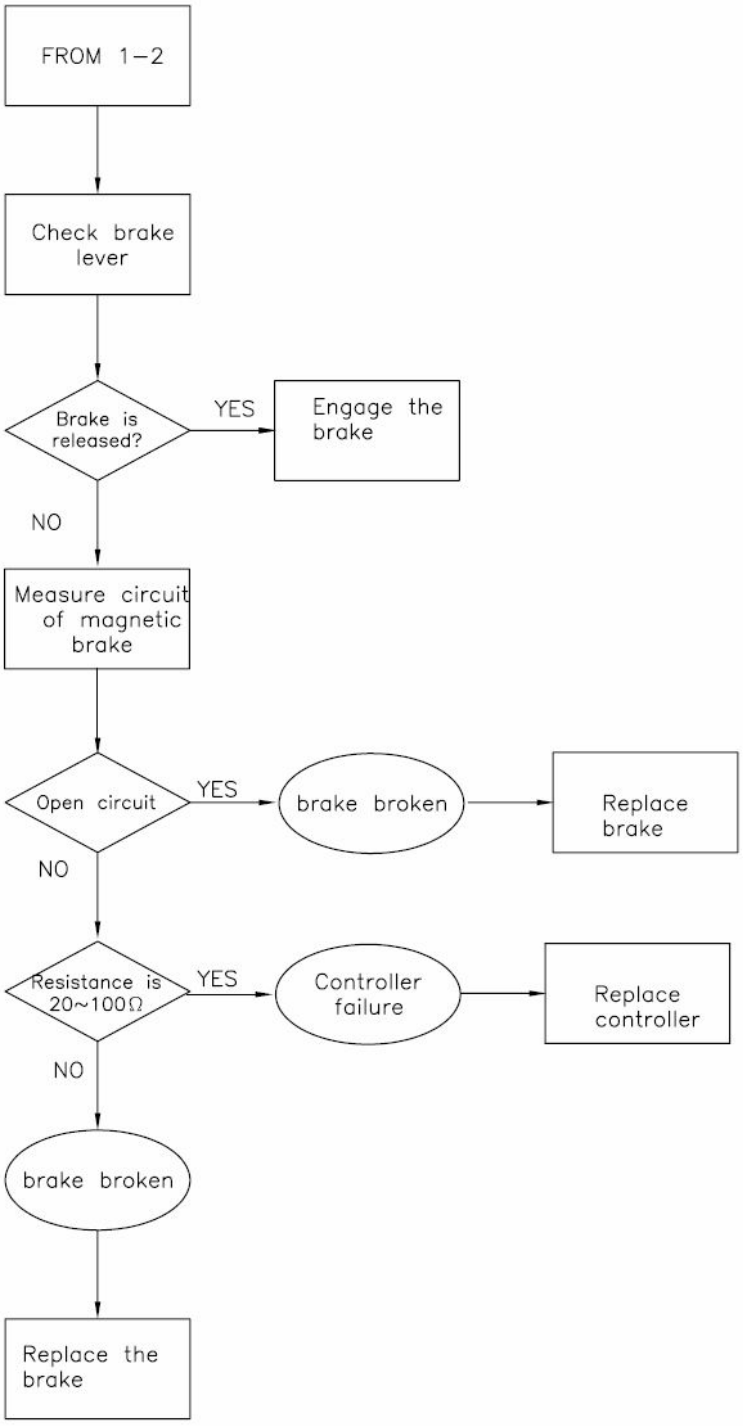
2–3 Voltage too high



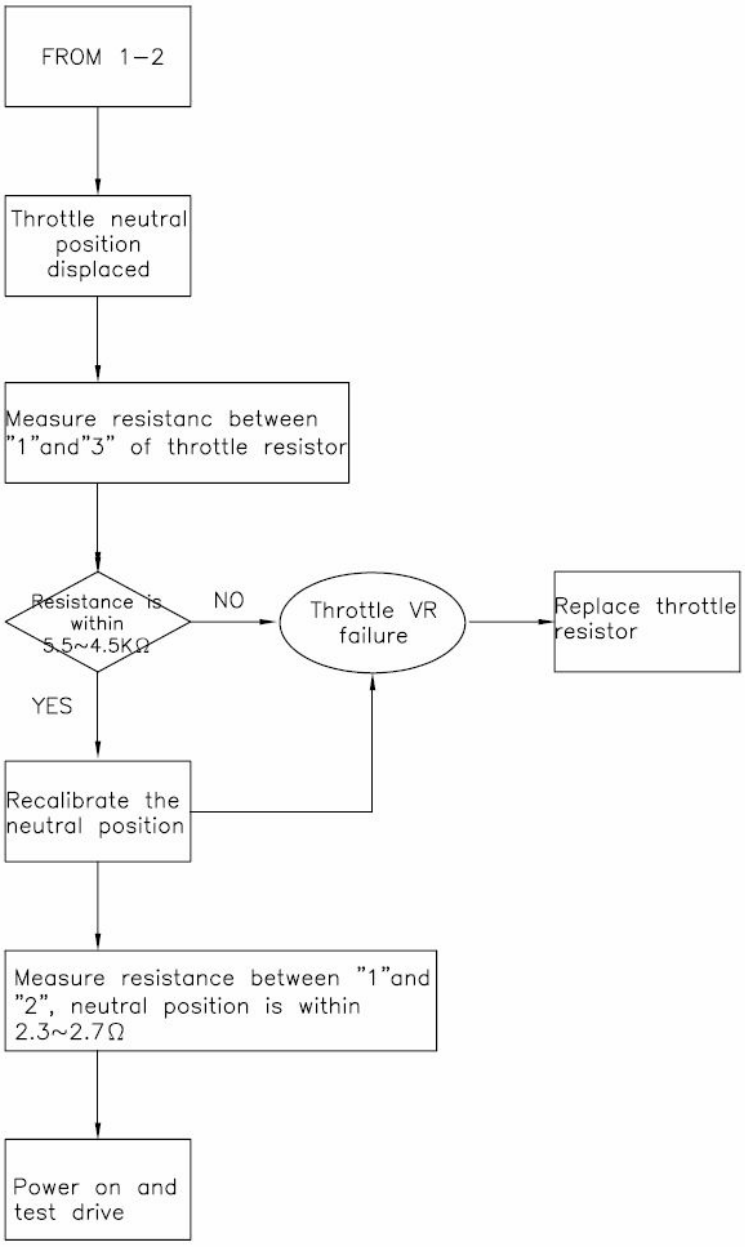
2-4 Current limit time-out



2–5 Brake fault

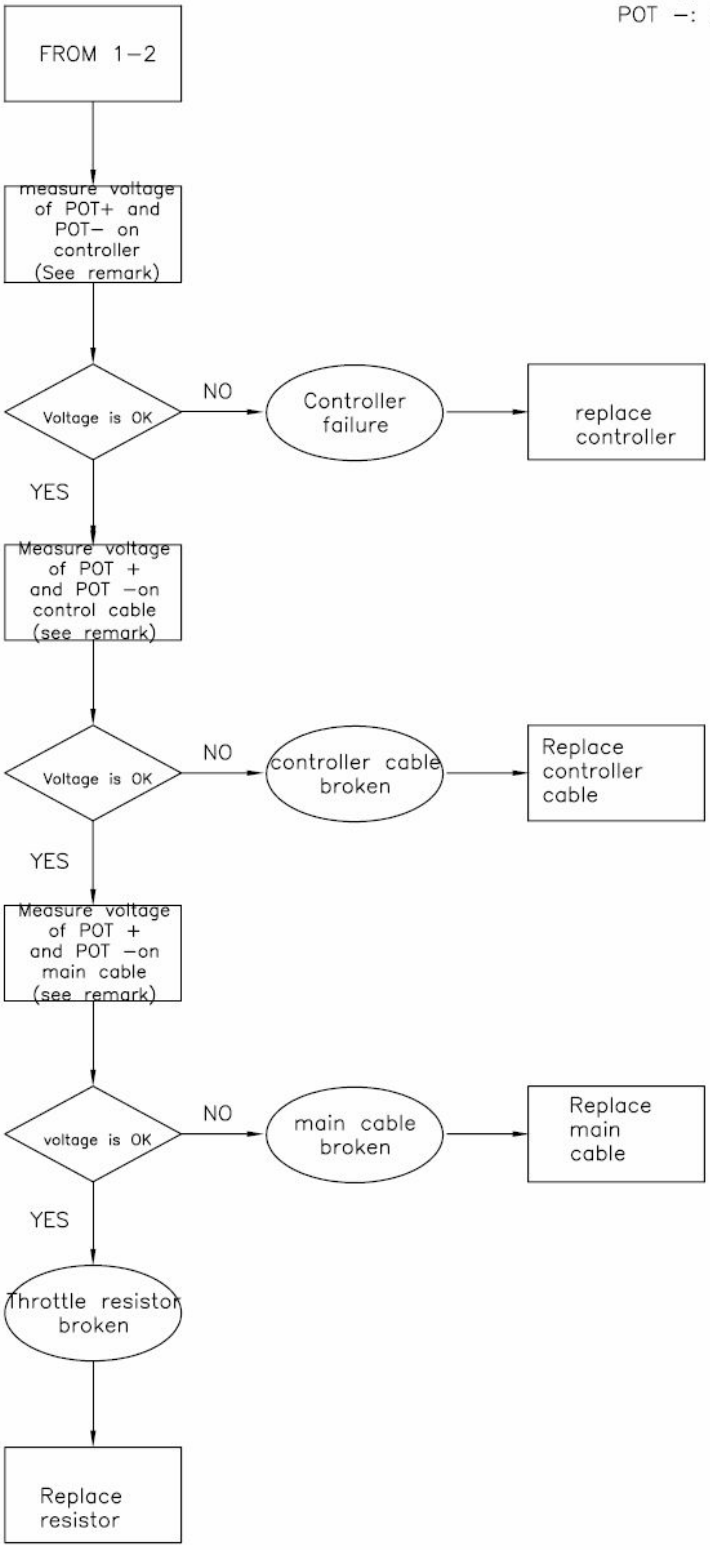


2-6 Throttle out of neutral at power-up

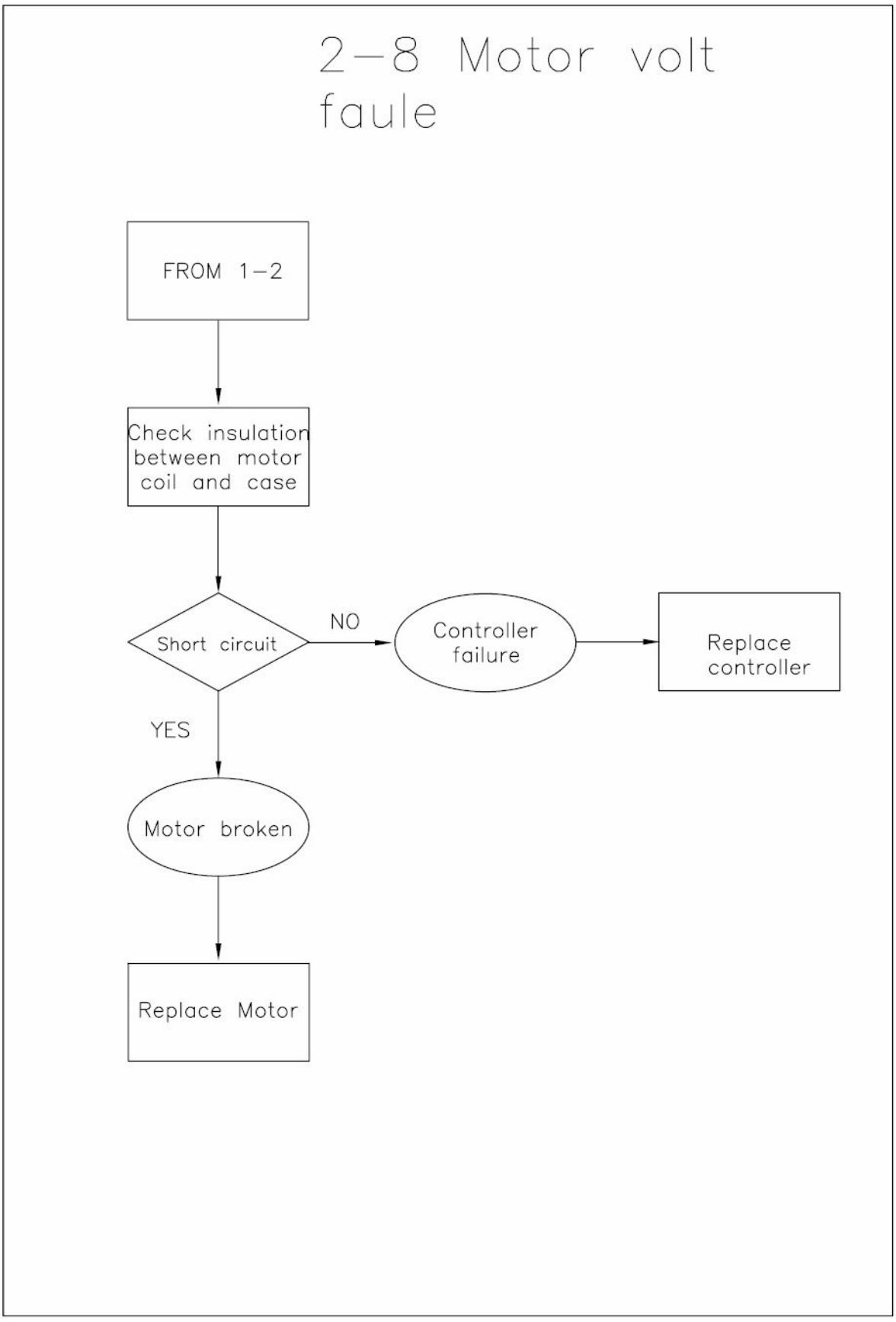

FROM 1-2
Throttle neutral position displaced
Measure resistanc between "1"and"3" of throttle resistor
Resistance is within 5.5~4.5KΩ
NO
Throttle VR failure
Replace throttle resistor
YES
Recalibrate the neutral position
Measure resistance between "1"and "2", neutral position is within 2.3~2.7Ω
Power on and test drive

2-7 POT error

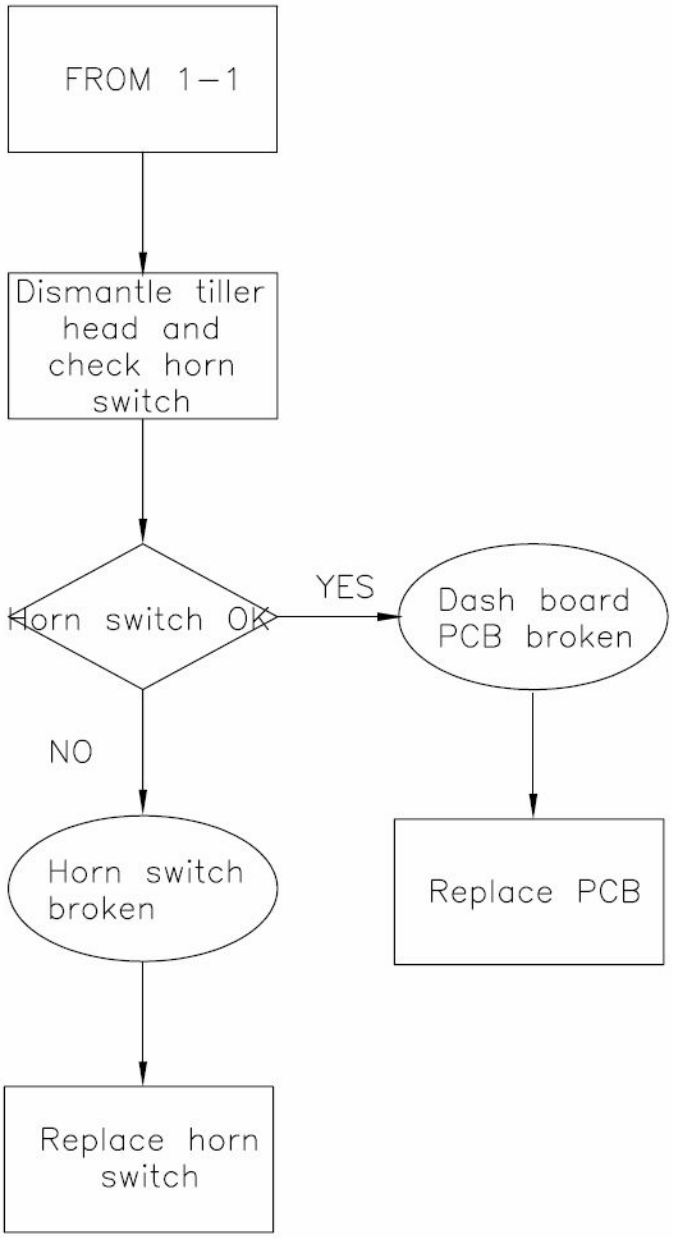
Remark:
POT +: 4.4~4.8VDC
POT −: 0.2~0.6VDC

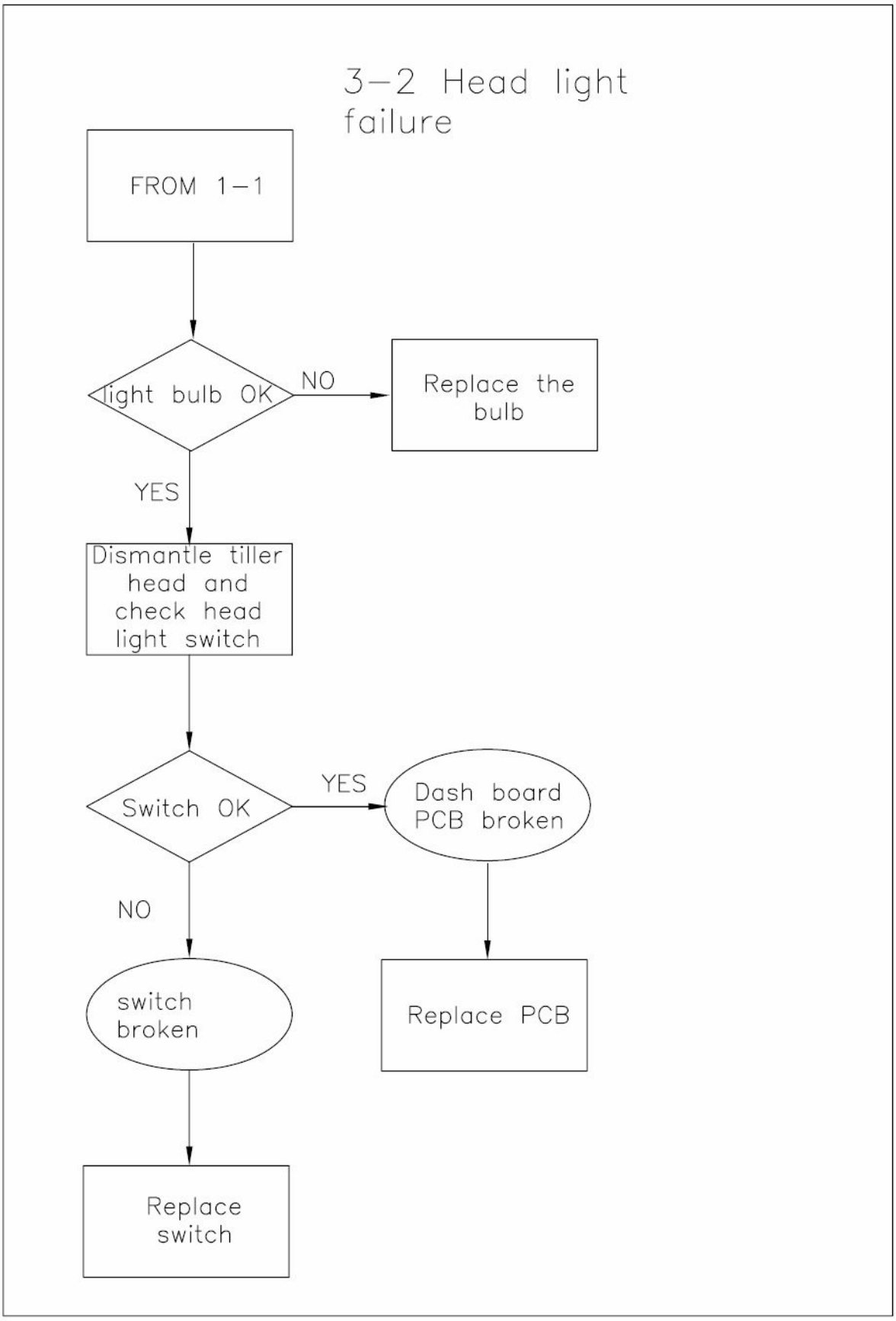


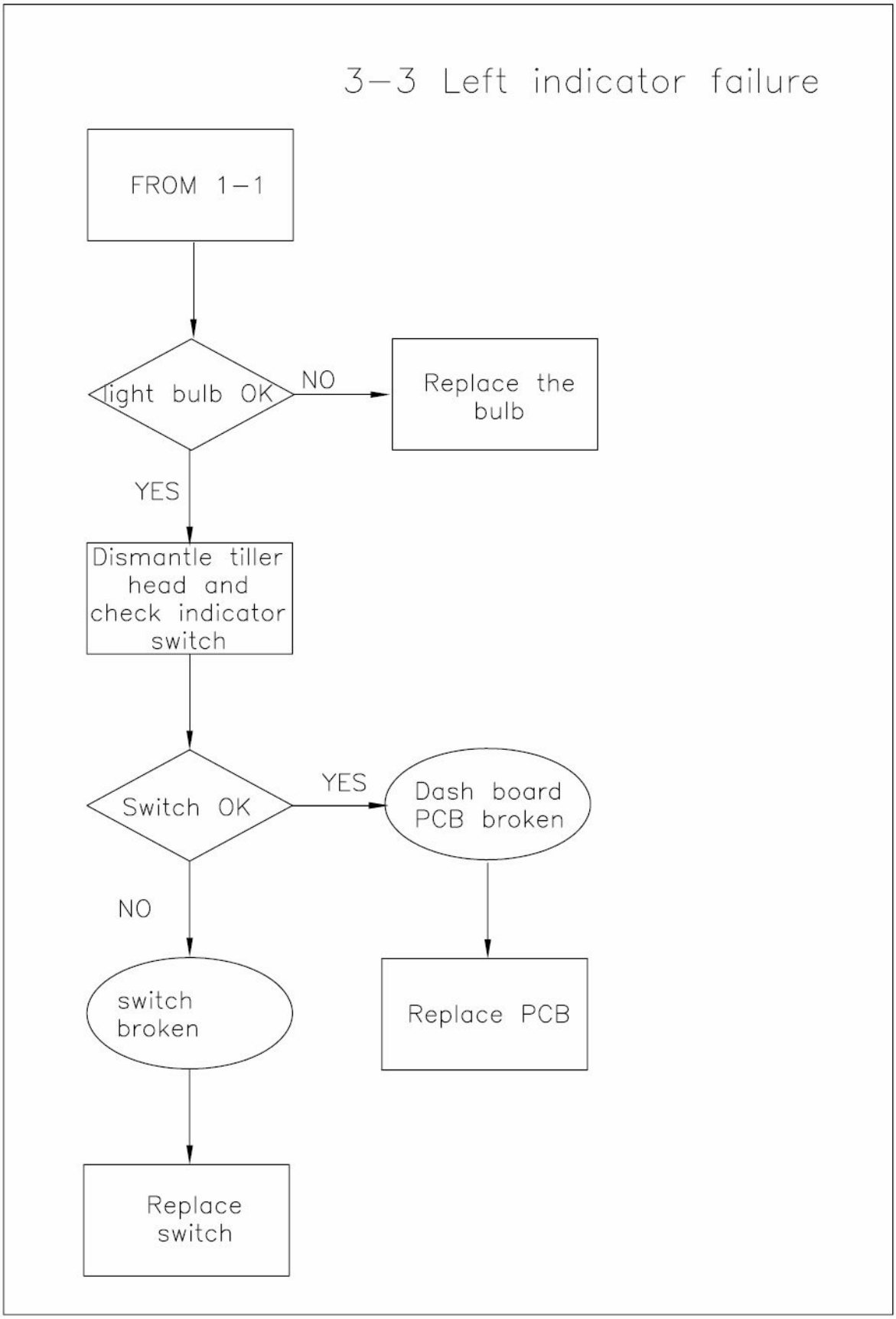
2-8 Motor volt faule

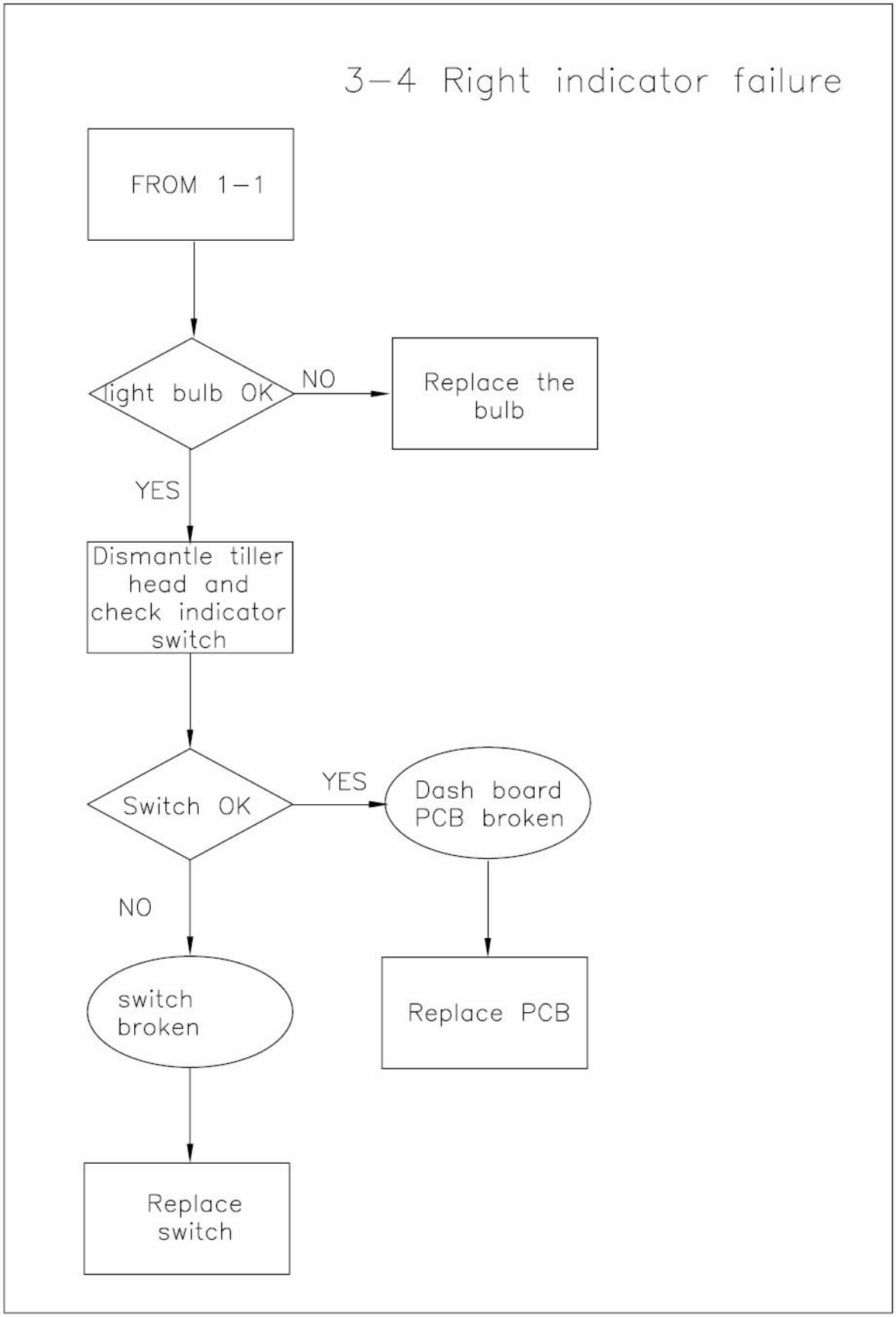


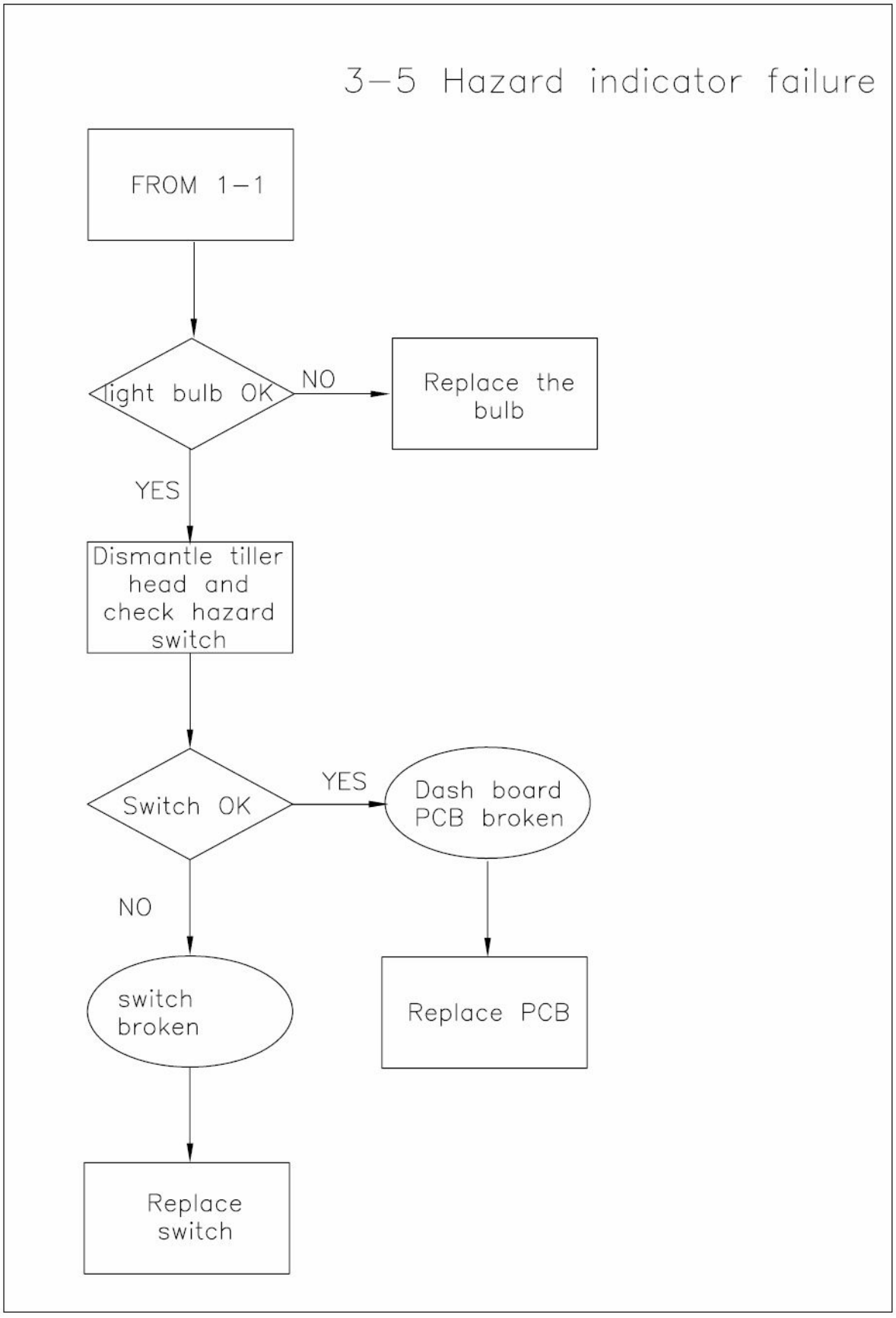
3－1 Horn failure




3–2 Head light failure
FROM 1–1
light bulb OK
NO
Replace the bulb
YES
Dismantle tiller head and check head light switch
Switch OK
YES
Dash board PCB broken
NO
switch broken
Replace PCB
Replace switch


3–3 Left indicator failure
FROM 1–1
light bulb OK
NO
Replace the bulb
YES
Dismantle tiller head and check indicator switch
Switch OK
YES
Dash board PCB broken
NO
switch broken
Replace PCB
Replace switch


3–4 Right indicator failure
FROM 1–1
light bulb OK
NO
Replace the bulb
YES
Dismantle tiller head and check indicator switch
Switch OK
YES
Dash board PCB broken
NO
switch broken
Replace PCB
Replace switch


3–5 Hazard indicator failure
FROM 1–1
light bulb OK
NO
Replace the bulb
YES
Dismantle tiller head and check hazard switch
Switch OK
YES
Dash board PCB broken
NO
switch broken
Replace PCB
Replace switch